Current Science

Vol. XX] AUGUST 1951 [No. 8

THE NEED FOR BIOPHYSICAL RESEARCH

THE main trend of scientific research in the present century has been the progressive intermingling of various branches, which were formerly considered as independent. Thus, physical chemistry and mathematical physics were the earliest to be recognized as distinct fields of study, while biochemistry has now been in existence for a considerable period as a separate discipline. But the application of physical and mathematical methods on a large scale to biological problems is a recent development, resulting in the emergence of 'biophysics' and 'biometry'. It is obvious that major developments are likely to occur in these comparatively virgin fields, which serve as common grounds for different well-established disciplines.

In the past, a few biologists have been interested in the physical aspects of their subject, and physicists have applied their methods to the study of living organisms. Unfortunately, however, there has been no uniformity in the approach to biophysics, nor even a clear conception of its scope and potentialities. The problems concerning the development of biophysics as a separate field of endeavour have been ably treated in an article by R. W. Stacey and his views have been discussed by a number of workers in another issue of *Science*.*

The term 'biophysics' may be used to cover broadly three types of studies : the physics of biological systems, the biological effects of physical agents and the use of physical methods in the study of biological problems. It is thus clear that biophysics covers a very large domain of knowledge, and that no logical and well-defined demarcation can be laid down between it on the one hand and the allied branches of physics and biology on the other. But there is no doubt that there exists at present a large area of no-man's-land between physics and biology, which would yield interesting results on exploration. For instance, there is an impressive volume of work waiting to be done on living matter at the microscopic, sub-microscopic and molecular levels. The worker interested in this phase would study tissue ultrastructure with the aid of physical instruments like the X-ray camera, the centrifuge and the electron-microscope. He would investigate the various properties of protoplasm like viscosity, elasticity, optical activity and

* "The Status and Development of Biophysics," *Science*, 1951, **113**, 169, 617.

so on. The thermodynamics of living matter constitute another fundamental field of research, rich in exciting biophysical problems. Spectrophotometric analysis of biological materials may constitute a real contribution to our knowledge of the molecular patterns in the protoplasm and to an understanding of the real nature of life. The measurement of bioelectric phenomena may lead to a proper understanding of neural and mental processes.

Man now travels faster and farther, higher in the air and deeper in the ocean, than ever before. He is exposed to new physical influences by virtue of the invention of new weapons and machines. We must learn the effects of these physical agents on living matter and the biophysicist has a large part to play in such studies. The rapid advances in nuclear physics have led to new and important aspects of biophysical research, such as the tracer isotope techniques and the effects of nuclear radiations on living matter. Again, physical instrumentation forms a major portion of the projected activity of the biophysicist.

Perhaps the reason why many of these subjects have not been investigated in detail in the past is that one needs a background both of biology and physics for a proper appreciation of the problems. Whether we like it or not, there is a difference in the approaches of physicists and biologists in tackling their problems, and it is difficult for one trained in one only of these disciplines to acquire the way of thinking of the other. There is obviously therefore, a need for the development of a special curriculum for training students who wish to take up biophysical research.

Researches in biophysics have been going on in other countries mostly through collaboration between workers in the two fields to which it is related. In some, as in France, regular courses of study are available in the subject. It is time that we in India too considered the possibility of affording courses, at the post-graduate level, to those who wish to take up research in this fascinating field. As a first step, summer courses may be given in the premier laboratories, to acquaint the biologists with the physical techniques that could be profitably used in their studies as also to familiarise the physicists with the basic concepts and ideas behind biological research. Workers in our country could expect to make significant contributions to this field, for it is still in the exploratory stage and not much spadework needs to be done in catching up with workers elsewhere as far as technique is concerned.

Let us therefore earnestly hope that active collaboration between workers in physics, chemistry and biology will soon be forthcoming from our universities and research institutions, to enable us to contribute our share to the field of biophysical research.

INTERNATIONAL CRYSTALLOGRAPHIC CONGRESS, 1951

THE SECOND INTERNATIONAL CONGRESS OF CRYSTALLOGRAPHY was held in Stockholm, from 27th June to 5th July 1951. More than 350 delegates from many countries attended the session. The three Indian delegates were Sir K. S. Krishnan, Prof. R. S. Krishnan and Mr. A. Verma.

Prof. A. Westgren, President of the Local Reception Committee, inaugurated the first plenary session with an address of welcome to the delegates. The Presidential Address was delivered by Sir Lawrence Bragg, the President of the Crystallographic Union. He gave a brief resumé of the history of the growth of X-ray crystal analysis starting from the pioneer work of von Laue and the two Braggs. He referred to the ever-increasing application of the techniques of X-ray crystallography in diverse branches of physics, chemistry, mineralogy, soil science, agriculture, biology and medicine.

The scientific meetings were divided into two sections, reading of papers and symposia. The contributed papers were broadly classified under the following heads:—order-disorder phenomena, various X-ray techniques, organic structures, electron diffraction, crystal growth, martensite, instruments, neutron diffraction, ferro-electrics, inorganic structures, metal structures, symmetry computing aids, minerals, protein and related structures, cold-worked metals, random and deformed structures, diffuse scattering and others.

On the 4th and 5th July, symposia were held on the following subjects: (1) advanced techniques in structure determination and (2) electron diffraction in gases. During the final plenary session it was decided to hold the third General Assembly in the summer of 1954 either in Paris or in Holland, and the following were elected to the Executive Committee for the period 1951-54:

President: Prof. J. M. Bijvoet (Holland), *Vice-Presidents*: Prof. G. Hagg (Sweden), Prof. J. Wyart (France), *Secretary*: Dr. R. C. Evans (United Kingdom), *Editor*: Prof. P. P. Ewald (U.S.A.), *Ordinary Members*: Prof. J. D. Bernal (United Kingdom), Sir K. S. Krishnan (India), Prof. E. Onorato (Italy), and Prof. A. L. Patterson (U.S.A.).

THEORY OF THE CAPACITY PHENOMENA DISPLAYED AT MERCURY CAPILLARY ELECTRODES*

K. S. G. DOSS AND A. KALYANASUNDARAM
(Indian Institute of Sugar Technology, Kanpur, India)

HEYROVSKY, SORM AND FOREJT[1] have described a new and interesting technique for the investigation of electrode kinetics which involves the study of oscillographic potential-time curves obtained by polarising the dropping mercury electrode with an alternating field. They found a peculiar phenomenon due to pyridine seemingly disagreeing with the ordinary run of polarographic experience. Pyridine is known not to be reducible in alkaline solutions[2] as it causes no wave on the polarographic current-voltage curves; yet, when added to an alkaline solution, it produces a marked effect on the oscillographic potential-time curve. There appears at a potential of about $-1{\cdot}5$ V. (with reference to saturated calomel electrode) a well pronounced time-lag, which indicates a depolarisation process. Since, however, the occurrence of an electrolytic process at that voltage must be excluded from polarographic experience, the stay at that potential has been explained on the basis of sudden changes in capacity.

That this phenomenon is not due to electrolytic reduction of pyridine is suggested by the fact that the concentration of pyridine at which the time-lag is shown, is about 100 times as large as that required to show a similar time-lag for an electrolytic depolariser. A closer investigation of this phenomenon revealed that the ordinary polarographic charging current shows in the same solution and at the same potential a sudden increase in the current. These large changes in the current have been identified by Heyrovsky and co-workers as due to desorption occurring to a large extent at the voltage at which the polarographic wave occurs. It is the object of the present note to formulate a theory to explain the phenomenon quantitatively.

The adsorption of pyridine may be caused by its hydrophobic tendency in alkaline solutions. In an attempt to get away from water it tends to concentrate at the mercury-sodium hydroxide interface. This takes place relatively unhampered at the electrocapillary zero. When more negative potentials are applied to the dropping electrode, the charged mercury surface attracts water molecules by dipolar attraction and hence the adsorption of pyridine is diminished. The rate of change of current would be closely following the rate of change of adsorption consequent on the change of potential. As Heyrovsky and co-workers have pointed out, the changes in current are due to the changes in the capacity of the dropping mercury electrode. It is reasonable to assume, therefore, that the maximum slope of the current-voltage curve would occur at practically the same potential as wherein the maximum slope occurs in the adsorption-voltage curve.

The expression for the variation of adsorption with potential of the dropping electrode can now be formulated. Following Glasstone, Laidler and Eyring,[3] we get:—

$$\frac{\theta}{1-\theta} = K_1 c e^{\epsilon/kT}, \qquad (1)$$

where θ = the fraction of the surface covered by adsorbed molecules, c = concentration of pyridine, k = gas constant, ϵ = heat of adsorption, and T = absolute temperature.

The effect of increasing the potential is to increase the attraction of water dipoles to the mercury surface which means that the heat of adsorption would get diminished with increased negative voltages beyond the electrocapillary zero. If ϵ_0 is the heat of adsorption of pyridine at the electrocapillary zero, it may be reasonable to suppose that in general the heat of adsorption is given by

$$\epsilon = \epsilon_0 - K_2 V, \qquad (2)$$

where V is the numerical value of the applied negative voltage with reference to electrocapillary zero and K_2 is a proportionality constant. The equation accordingly becomes

$$\frac{\theta}{1-\theta} = K_3 c e^{-K_2 V/kT} e^{-\epsilon_0/kT}, \qquad (3)$$

where $K_3 = K_1 e$

Differentiating, we get

$$\frac{d\theta}{dV} = -\theta\ (1-\theta)\ \frac{K_2}{kT}. \qquad (4)$$

An examination of equation (4) shows that $\frac{d\theta}{dV}$ becomes maximum when $\theta = \frac{1}{2}$, if the concentration of pyridine is so high that at the electrocapillary zero θ is equal to or greater than $\frac{1}{2}$. (If, however, the concentration of pyridine becomes so low that θ is less than $\frac{1}{2}$, the maximum for $\frac{d\theta}{dV}$ occurs at the electrocapillary zero itself.)

* The authors wish to thank the Uttar Pradesh Scientific Research Committee for a grant on a scheme of 'Electrode Processes,' of which this work forms a part.

Putting $\theta = \frac{1}{2}$ in equation (3), we get

$$K_3 c e^{-\frac{K_2 V^*}{kT}} = 1$$

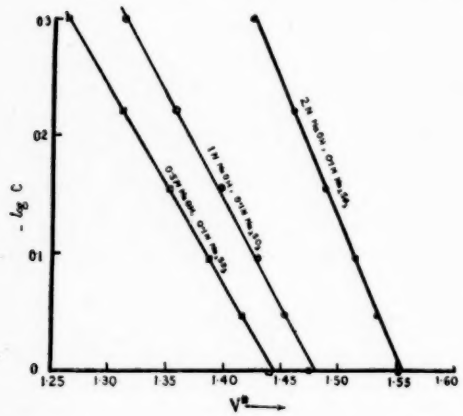


FIG. 1

where V^* is the potential corresponding to the inflection in the polarographic curve.

Therefore, $V^* = \frac{kT}{K_2} \log K_3 + \frac{kT}{K_2} \log c$. (5)

This shows that V^* should be a rectilinear function of log c. Fig. 1 gives the curves plotted on the basis of the data of Heyrovsky and co-workers.[1] An examination of the curves shows a satisfactory rectilinear relationship, as predicted by the above formulation.

Though this formulation is primarily for condenser current, it can also apply to the shift of the half-wave potentials of reactions hindered by the adsorbed pyridine, as for example the shift of the second wave of the polarographic reduction of oxygen.

1. Heyrovsky and others, *Czechoslovak Chemical Communications*, 1947, **12**, Nos. 1-2. 2. Knobloch, E., (*Czech*) *Chem. listy.*, 1945, **39**, 54-60. 3. Glasstone, Laidler and Eyring, *The Theory of Rate Processes*, McGraw-Hill, 1941.

HINDUSTAN TRAINER—2

THE first step towards self-sufficiency in aviation, may be said to have been achieved recently when HT-2, the first Indian designed and built prototype aircraft, carried out its flight trials successfully.

The HT-2 is an all-metal, monoplane of 2,100 lb. gross weight, powered by a Gipsy Major 10 Engine of 145 rated horse power. Many special features have been incorporated in the design and construction of this aircraft which makes it superior to similar type of foreign aircraft in the market. The aircraft is all metal including the control surfaces, which reduces the maintenance cost in operation in varying Indian climatic conditions. Secondly, the controls are operated by "push pull rods" instead of cables, thereby eliminating any lag and delay in the operation of controls. The aircraft is fully ærobatic, *unrestricted* for the total gross weight which is a feature very few trainer aircraft possess.

Except for the engine and the instruments, all the major components of this prototype are designed and manufactured at Hindustan Aircraft Factory. The design team was headed by Dr. V. M. Ghatage, Chief Designer of the factory, assisted by a few foreign-trained Indian aeronautical engineers and a group of engineers from the Indian Institute of Science.

SINDRI FERTILIZER FACTORY

SINDRI FERTILIZER FACTORY, which will start functioning in September, has a production target of 350,000 tons a year. This annual target is expected to be reached during 1953.

The factory has been planned in such a way that the outturn can be doubled by the installation of additional equipment. Alternately, it can also be expanded to produce different types of products such as nitric acid for India's chemical industry in general, ammonium nitrate or nitro-chalk as fertilizers, etc.

An experiment successfully carried out at Sindri regarding water supply is worth mentioning. This is the construction of an infiltration gallery to extract sub-surface water running below the sands in the bed of the Damodar river during the hot season when the surface flow dries up. Tests have already proved that the infiltration gallery can yield between five and six million gallons of water a day.

Another feature of interest is that in the process of manufacture of 1,000 tons of ammonium sulphate per day, about 900 tons of calcium carbonate sludge are expected to be thrown up as a by-product. Plans are under the consideration of the Government of India for utilising this by-product as a raw material for a cement factory with an installed capacity of 300 tons per day of first class Portland cement.

LETTERS TO THE EDITOR

SCATTERING OF LIGHT IN WATER KEPT IN CONTACT WITH METALS

IT is a matter of some practical importance to know whether and if so, in what form, metals go into solution when they are kept in contact with water. The problem was investigated by using the method of light scattering. The intensity and polarisation characters of light scattered transversely by dust-free, double-distilled water kept in contact with gold, silver, copper and brass were studied as a function of time.

Pure dust-free water is collected in a round-bottomed flask of 250 c.c. capacity and the metal under test is placed in the bottom of the flask and washed several times before the flask is finally filled with water from a distillation outfit. The flask is blackened outside leaving circular holes for ingress and egress of light and light from a powerful carbon arc is focussed on the water. The intensity of light scattered transversely is measured by comparison with that of a standard source using a Lummer-Brodhun cube and the depolarisation measurements are made by the well-known Cornu method. Measurements are made at the end of every half-hour for the first five hours and afterwards at the end of every five hours. In order to make sure that the results are not vitiated by contamination of water by the impurities of air, a test experiment was carried out with silver bits placed in the flask and distilling water into it by vacuum distillation. Results more or less identical with that given by the open distillation method, were obtained.

The effect of copper, silver and brass on water is to increase the intensity of scattering rapidly in the first five hours and afterwards slowly till a steady value is reached in about 48 hours. The results of the measurements are given in Table I. The effect due to silver is most marked, the maximum increase being

TABLE I

Intensity of Scattering: Reading for Fresh Double-Distilled Water = 1·5

Time in hours	Water in contact with		
	Silver	Copper	Brass
0	2·103	2·146	2
½	2·253	2·199	2·09
1	2·397	2·253	2·10
1½	2·508	2·253	2·13
2	2·547	2·306	2·15
2½	2·644	2·350	2·20
3	2·703	2·378	2·226
3½	2·789	2·453	2·235
4	2·859	2·453	2·25
4½	2· 90	..	2·30
5	2·952	2·547	2·312
6	3·032	2·605	2·35
7	3·17	2·654	2·378
24	4·077	3·356	2·88
32	4·196	3·445	2·88
48	4·24	3·534	2·88

nearly three times that of pure water. Copper comes next and brass last. It is also observed that gold does not affect the intensity appreciably. The track of scattered light is blue and homogeneous showing that the scattering particles are uniformly dispersed and in fine colloidal form.

The values of ρ_u, ρ_v and ρ_h (calculated using Krishnan's Reciprocity relation) for silver and copper samples are given in Table II.

TABLE II

Time of contact in hrs.	ρ_u%		ρ_v%		ρ_h%	
	Silver	Copper	Silver	Copper	Silver	Copper
0	9·0	9·51	4·66	4·75	95·8	91·02
6	10·62	11·38	5·26	5·57	88·86	86·49
12	12·53	14·05	5·90	6·78	80·3	82·48
24	14·88	16·64	6·43	7·40	68·34	70·68
48	17·29	18·83	6·58	7·86	55·53	63·14
72	17·31	18·85	6·60	7·80	55·69	62·30

The finite values of ρ_v and ρ_h indicate that the scattering particles are anisotropic and not small compared with the wavelength of light. With increase of time of contact, ρ_v increases slowly, indicating a slight increase in anisotropy of the particles. ρ_h decreases at first rapidly and afterwards slowly till it reaches a minimum value. From this it may be concluded that the particle-size of the metal sol gradually gains in size.

My thanks are due to Dr. C. S. Venkateswaran, Principal, University College, for suggesting the problem and for his keen interest in the work.

Univ. College, Trivandrum, *June* 12, 1951. MRS. ALEYAMMA GEORGE.

SCATTERING OF LIGHT IN COLLOIDAL DYE SOLUTIONS

A STUDY of the colloidal properties of the dyes is of importance as there is a close relationship between the micellar nature and the kinetics of the dyeing process. A study of the scattering of light in certain dye solutions (Chrysophenine G and Benzopurpurine 4B) has been undertaken by the author with a view to determining the state of aggregation and the anisotropy of the dye micelles in solution under different conditions.

The experimental methods used were mainly the same as those employed by R. S. Krishnan[1] except that incident white light was used. The depolarisation values and the intensity of the tranversely scattered light (in terms of the microammeter reading in the photo-electric amplifier) for a particular dye and salt concentration at different temperatures are given in Tables I and II.

TABLE I

Chrysophenine G 0·066 gram/litre, NaCl 8 grams/litre.

Temperature in °C.	ρ_u%	ρ_v%	ρ_h%	$\Delta\rho_u$%	Intensity
26	26	14·7	100	0	7·6
30	17	7·0	61	4	6·4
35	16	5·8	42	5	5·0
40	16	4·5	33	7·4	4·0
55–85	16	4·2	32	8·0	3·0

TABLE II

Benzopurpurine 4B 0·082 gram/litre, NaCl 12 grams/litre

Temperature in °C.	ρ_u%	ρ_v%	ρ_h%	$\Delta\rho_u$	Intensity
27	8·5	3·6	70	1·5	2·8
35	11	4·3	63	3·0	3·0
40	14	4·7	54	5·0	3·1
50	16	5·8	50	5·0	3·4
60	19	8·0	56	4·0	3·1
65	20	8·8	56	3·8	2·7

Care was taken to ensure that the salt concentration was small enough so as not to affect

the stability of the sol. $\Delta\rho_u$ has been calculated from the equation $\Delta\rho_u = \rho_u$ (obs.) $- 2\rho_v/(1+\rho_v)$. To a first approximation, the anisotropic part of ρ_u can be considered as equal[2,3] $\frac{2\rho_v}{(1+\rho_v)}$ and the difference may be taken as a measure of the finite size of the scattering particle. ρ_h, which is 100 per cent. for small anisotropic particles, reduces to zero for large isotropic particles and it is also a measure of the size of the scattering particle. Further the intensity due to pure density scattering is proportional to the absolute temperature and a decrease in the intensity of the scattered light with rise of temperature is to be attributed to a formation of clusters or large micelles.

From the experimental observations given above, it is clear that, while the micelles of Chrysophenine G at 26° C. are small and anisotropic, those of Benzopurpurine 4 B are anisotropic and of size not small compared with the wavelength of light. In the case of Chrysophenine G the intensity as well as the depolarisation values show a gradual decrease followed by a sudden drop at a temperature which may be called the "transition" temperature. These facts indicate that, even at higher temperatures, larger but more spherical micelles are present and this result for Chrysophenine G is in keeping with Morton's[4] observations based on ultrafiltration experiments. On the other hand, Benzopurpurine 4 B shows a continuous increase of ρ_v and a minimum value for ρ_h at the transition temperature due to the formation of larger and more anisotropic micelles. Such a result can be expected if the micelles group end to end and grow only in one direction. Beyond the transition temperature, $\Delta\rho_u$ decreases and ρ_h increases showing thereby that the micelles are now probably going into solution. The transition temperature in the case of both the dyes is a function of the dye and salt concentrations. Further work is being continued and a detailed report will be published elsewhere.

My thanks are due to Prof. R. S. Krishnan for his help and encouragement.

Dept. of Physics, S. R. SIVARAJAN.
Indian Institute of Science,
Bangalore,
June 21, 1951.

1. Krishnan, R. S., *Proc. Ind. Acad. Sci.*, **1937, 5,** 551. 2. Gans, *Ann. der Phys.*, **1912, 37, 883.** 3. Bhagavantam, *Scattering of Light and the Raman Effect*, Chemical Publishing Co., **1942.** 4. Morton, *Trans. Faraday Soc.*, **1935, 31,** 262.

ON THE RECOGNITION OF FAULTS IN THE GRANITIC TERRAIN IN MYSORE

THE recognition of planes of dislocation in areas covered entirely by crystalline rocks is a matter of difficulty. Excepting in areas like the Kolar schist belt where exploitation of the gold quartz veins by deep mining has laid bare the structure and helped to identify and trace several faults, in all other cases in Mysore, surface observation alone has rarely suggested the existence of planes of dislocation.

During the course of our recent work tracing the boundary between the Closepet granite and the Peninsular gneiss some twenty miles west of Bangalore, we came upon a clear instance of faulting in a region covered almost entirely by different types of banded gneisses and granites. It is our object to describe the geological features of this region which has enabled us to conclude the existence of clearly recognisable fault planes.

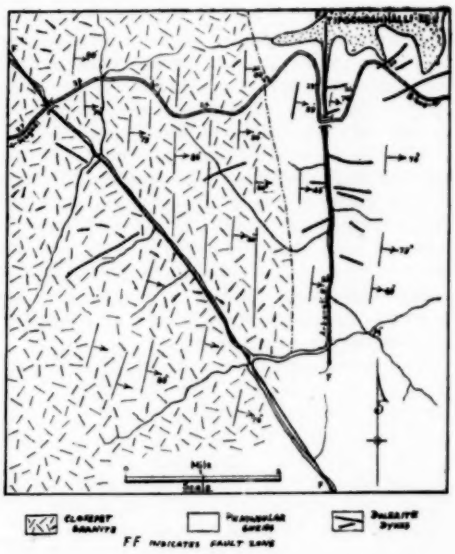


FIG. 1

A portion of the 1″ sheet of the region surveyed is here reproduced to show the topographic peculiarities of the area. The one outstanding feature which strikes our attention is the remarkably straight course of the river Arkavati and its tributary stream. The straight courses of rivers over considerable distances cannot be an accidental feature. Moreover, these streams flow in narrow gorges and the conclusion is inescapable

that these narrow zones represent planes of weakess, probably fault zones.

Our attention was, therefore, concentrated on a close study of the geologic features of the region in the immediate neighbourhood of the river Arkavati and its tributary to find out whether any positive evidences of faulting were forthcoming.

The geology of the area is fairly simple. The rocks to the east of the river are mostly granitic gneisses with a strike of 10° E of North and dipping at high angles of 75° and more to the east. There are occasional bands of pink gneiss amidst the granitic gneisses. The rock types west of the river are also gneissic with a greater preponderance of the pink bands on account of the proximity to the Closepet granites. The strike of the gneisses is very nearly North-South and the dip varies from 40° to 50° E.

The river bed is the most interesting part. This is occupied by a band about 100 feet in width of a feldspar-quartz-rock, with numerous veins and veinlets of bright green epidote. The feldspar is invariably of a deep flesh red colour. This narrow belt is highly crushed and jointed. The pinkish feldspathic portions appear more like veins in the crushed zones. They occur in the form of a series of parallel veins healing up the fractures. There are frequent changes in the strike direction of these veins.

Two furlongs downstream from the waste weir of the Tipgondanahalli reservoir, evidences of faulting are still more clear. At this point, water flows in one straight line for a distance of more than 200 yards in a narrow drain about 10 feet wide. The slickensided face and the straight edge of the fault are very well exposed. The fault plane is seen to dip towards the east at an angle of 50°.

The behaviour of the dolerite dykes on either side of the fault line provides further confirmatory evidence of faulting. Several dykes of dolerite are seen crossing the region in a roughly east-west direction. The dykes are seen to terminate abruptly at the junction with the fault plane. The continuation of these dykes on the other side of the fault is not traceable.

These evidences were again verified in the case of the tributary stream which crosses the Magadi road near the 5/27 milestone. This stream too, as can be seen from the map, has a straight course for nearly 9 miles. The only difference in this case is that the line of river flow is oblique to the strike direction of the rocks. Outcrops of rock are not numerous in the stream bed, but where present they show the deep flesh-red feldspathic rock with veins of green epidote. The phenocrysts in the adjoining gneiss too are seen to have turned a deep red colour.

The straight courses of streams and streamlets for considerable distances, the presence of peculiar and characteristic type of fault rock made up of flesh-red feldspar and bright green epidote, the abrupt stoppage of dykes at contact with these planes of dislocation are indicative of the existence of fault planes. Taken singly or together, these features serve to distinguish fault zones in areas covered by granitic rocks where identification of such structures is by no means easy.

Mysore Geol. Dept. B. P. RADHAKRISHNA.
Bangalore 1, MOHAMAD GHOUSE.
July 6, 1951.

ON A SAMPLE OF "PLAGIOCLASE-GRANULITE" (ANORTHOSITE) ASSOCIATED WITH CALC-GRANULITES IN NORTH MANBHUM

THE occurrence, in North Manbhum, of a granulitic rock identical to anorthosite in composition, and hence an anorthosite for all purposes, is being reported here for the first time. The credit of its discovery goes to the junior author.

The rock occurs in close association with typical calc-granulites and amphibolites (86°42′30″ E; 23°31′ N approximately), all showing gradual lateral passage (*cf.* also[1] and[2]); and consists of acid bytownite, or rather labradorite-bytownite ($2V\alpha = 85°$) as the chief constituent with accessory hornblende, epidote-zoisite and calcite. There are alternating hornblende rich (amphibolite) bands occurring in thin streaks, similar to those seen in the calc-silicate granulites from Pahargora.[1]

The rock is genetically connected with calc-granulites, and assemblages show a passage from one type to the other by a change in the relative proportion of the constituent minerals. This variation, characteristic of these rocks, has been ascribed to an original difference in composition of the sediments. The related assemblages with various combinations and varying proportions of plagioclase, diopside, calcite, tremolite and hornblende are characteristic of the paragenesis of cordierite-anthophyllite subfacies of the amphibolite facies.

Another fact worthy of mention is the association of kaolin with these rocks (Dhatara), a feature also noticed by Chatterjee in case of the white anorthosites of Bankura[3].

The rock is not being described as an anorthosite straight off on account of its very distinctive, but easily readable, genetic

features. But it shows, nonetheless, all characters essentially those of typical anorthosites, such as are met with in rocks described from Raniganj.[3] Indeed the two could not be told apart either in hand specimens or from their mineralogical and textural characters. It seems possible, thus, that anorthosites and anorthosite assemblages could very well be produced by high grade metamorphism of calcareous sediments having sufficient aluminous impurities and very little or no magnesia.

We appreciate fully the very serious import of the implication, but in view of the unequivocal field relations, we wish to draw attention of petrologists working in related fields, to such a possibility.

SAURINDRANATH SEN.
Calcutta University, BIMALENDU ROY
March 3, 1951. CHOWDHURY.

1. Sen, Raychaudhuri and Mukherjee, *Sci. and Culture*, **14**. 2. Sen, S., *Proc. Ind. Sci. Congr.*, 1951, **3**. 3. Chatterjee, S., *Anorthosite of Bengal*.

ISOLATION OF NEW NIOBATES

THE niobates of the alkali,[1,2] alkaline earth and a few other metals[3-4] have been prepared. However literature does not record the existence of the niobates of lead, tin and some heavy metals. Recently a new niobate of lithium and a tartratoniobate of lead were reported.[5-6] Hence studies on niobates were undertaken and two new niobates (of lead and tin) have been isolated.

The general method of preparation of the niobates consisted in reacting, under suitable conditions, a soluble salt of the metal with sodium niobate. Sodium niobate $Na_2O \cdot Nb_2O_5 \cdot 7H_2O$ was prepared from very pure materials by the method of Balke and Smith.[7] To a hot clear solution of sodium niobate, a hot 10% solution of lead nitrate or acetate was added in a thin stream with rapid stirring, when a dense white curdy precipitate was formed. It was filtered, washed thoroughly and dried. The compound was analysed for lead and niobium by a method which was evolved. It has been found to occur in two hydrates having the following percentage compositions:

I. PbO—39·40, Nb_2O_5—44·09, H_2O—16·51 ;
II. PbO—34·31, Nb_2O_5—39·95 H_2O—25·74.

The results agree closely with calculated values and therefore the new lead niobate isolated has the formula $PbO.\ Nb_2O_5\ nH_2O$ (where $n = 5$ or 10). Lead niobate is a white insoluble powder. Dehydration studies on the two hydrates have been conducted and it has been found that there is a loss of nearly three molecules of water by keeping at 110° C. for about 5 hours.

The preparation of the anhydrous lead niobate has been attempted by the fusion of equimolecular proportions of lead carbonate and niobium pentoxide.

A niobate of tin has been prepared by the reaction of stannous chloride with sodium niobate. It is worth recording that on the addition of stannous chloride, a white precipitate is formed which immediately changes colour to yellow. The compound has been analysed and found to have the percentage composition, SnO_2—37·57, Nb_2O_5—46·26, H_2O—14·07. It is interesting that in the case of tin, a niobate ($4\ SnO_2 \cdot 3Nb_2O_5 \cdot 13\ H_2O$), with a base to acid ratio of 4 : 3 is formed, which is usually encountered in the alkali metals.

A bismuth niobate has just been prepared and full details will be published elsewhere.

We have pleasure in thanking Prof. Brahm Prakash for his kind interest in the work.

Dept. of Metallurgy, N. R. SRINIVASAN,
Indian Institute of Science, K. VENUGOPALAN.
Bangalore 3,
June 25, 1951.

1. Rose, *Pogg. Ann.*, 1861, **113**, 105, 291. 2. Bedford, *Jour. Amer. Chem. Soc.*, 1905, **27**, 1216. 3. Larsson, *Z. Anorg. Chem.*, 1896, **12**, 188. 4. Balke and Smith, *Jour. Amer. Chem. Soc.*, 1908, **30**, 1637. 5. Srinivasan, *Proc. Ind. Acad. Sci.*, 1950, **31A**, 304. 6. —, *Ibid.*, 1950, **31A**, 385. 7. Balke and Smith, *loc. cit.*

AN IMPROVED METHOD FOR THE CYCLIZATION OF ARYL ω-DIMETHOXYETHYL SULPHIDES

A NEW synthesis of thionaphthene, which has been extended to substituted thionaphthenes and to other thiophenes and thiapyrans, consisting of the cyclization of phenyl ω-dimethoxyethyl sulphide (I) by treatment with phosphorus pentoxide-phosphoric acid mixture in an optimum yield of 37% has been described recently by us.[1] The yield was, however, only 37%. Attempts to effect ring-closure of (I) by treatment with fused sodium acetate and acetic anhydride, fused zinc chloride and glycerine, glacial acetic acid or acetic anhydride anhydrous oxalic acid and pyridine hydrochloride at temperatures varying, from room temperature to 180° were unsuccessful. Attempts at the cyclization of (I) by means of phosphorus pentoxide-phosphoric acid mixture at 0°, room temperature (27-29°) and at 60°

led to an oil which gave a dinitrophenylhydrazone of *S*-phenylthioglycolic-aldehyde but not thionaphthene picrate. The yield of thionaphthene from (I) was finally improved from 37 to 72·5 per cent by carrying out the cyclization as follows:— A mixture of phosphorus pentoxide (34 g.) and phosphoric acid (21 c.c.) was heated to 170-80° in vacuum (10 mm.) and (I) (8·5 g.) was then added to the separating funnel from which it was led to the acid mixture during 30 minutes. The residual sulphide was rinsed with a little benzene. Thionaphthene, which formed the distillate, was collected in an ice-cooled receiver which was connected to vacuum through an ice-cooled trap. The crude thionaphthene (5·10 g., yield 89%) did not give a dinitrophenylhydrazone, but readily formed the picrate. It was distilled twice under reduced pressure and finally steam-distilled when the yield dropped to 72·5%. The purified thionaphthene melted at 26·5-27·5°.

Cyclization of *m*-tolyl ω-dimethoxyethyl sulphide (7 g.) by treatment with phosphorus pentoxide (28 g.)-phosphoric acid (17 c.c.) mixture at 160-70°/10 mm. under the above conditions gave a 95% yield (4·65 g.) of crude 6-methylthionaphthene, the yield after steam distillation was 78% (3·83 g.). Similarly, *o*-bromophenyl ω-dimethoxyethyl sulphide (3 g.), on treatment with phosphorous pentoxide (12 g.)-phosphoric acid (15 c.c.) at 170-80°/10 mm., gave the hitherto unreported 7-bromothionaphthene (1·64 g., yield 72%), b. p. 107-09°/10 mm. (picrate, m. p. 144-45°).

Dept. of Chem. Technology, K. RABINDRAN.
University of Bombay, B. D. TILAK.
April 10, 1951.

1. Tilak, *et al.*, *Proc. Indian Acad. Sci.*, 1950, **32A**, 390, *et sequa.*

THE FLUORESCENCE TEST AS APPLIED TO CARBOXYLIC ACIDS

THE fluorescence test is usually carried out by heating together small quantities of resorcinol and phthalic or succinic acid (or their anhydride) in presence of a few drops of conc. H_2SO_4, pouring it in water, which on making alkaline to NaOH gives a green orange fluorescence. The test is recommended in several text books[1] for the detection of the above acids and their anhydrides. Perkin and Kipping[2] mention its applicability for the detection of inner anhydrides while Bernthsen and Sudborough[3] record that benzoic acid also gives this test.

We have observed that aliphatic monobasic acids (*e.g.* formic to butyric, oleic, palmitic, stearic, monochloroacetic and lactic), aromatic monobasic acids (*e.g. o*- and *m*-toluic, *m*-hydroxybenzoic, gallic, cinnamic, salicylic and hippuric), and others, such as nicotinic and uric acids also give the test similar to that of phthalic and succinic acids, showing that the test cannot be taken as characteristic of the latter only.

The final alkaline solutions retain their green-orange fluorescence even on prolonged exposure to air; only in some cases (*e.g.* acetic, monochloro-acetic and lactic) it changes to a violet fluorescence.

The blue fluorescence of malic and citric acids, when subjected to this test, may be ascribed to the formation of 7-hydroxy coumarin derivatives which are known to fluorescence in this manner in alkaline media. All the experiments were performed using conc. H_2SO_4 (A. R. quality), pure resorcinol (of Rhodia, medicinal quality) and the purest available organic acids and the reproducibility of every test has been ascertained.

The green-orange fluorescence may be due to compounds formed by the condensation of resorcinol with the organic acid in presence of conc. H_2SO_4. Although no systematic work appears to have been done in this direction, some workers [4,8] have condensed resorcinol with certain carboxylic acids in presence of anhydrous zinc chloride. Only in a few cases the green orange fluorescence of the products of condensation has been reported.

Beilstein records that on heating resorcinol in a sealed tube, or along with anhydrous $ZnCl_2$, HCl, or conc. H_2SO_4, some compounds are formed which fluoresce in alkaline media. We have found that resorcinol does so with conc. H_2SO_4 only under very particular conditions which are different from those usually employed for the reaction between resorcinol, carboxylic acids and conc. H_2SO_4. A green-orange fluorescence is obtained when 0·5 g. of resorcinol and 0·2 c.c. of conc. H_2SO_4 are heated in a test-tube for one minute in a bath at 170°; the resulting dark red liquid is allowed to cool, mixed with about 50 c. c. of water and a few c.c. of NaOH are added to render it alkaline. Any deviation from these conditions gives faintly fluorescing or a mere orange coloured solution. The fluorescence of the alkali solution, however, disappears completely on exposure to air for a few hours.

Further work is in progress particularly with a view to determine the nature of the fluore-

scent products obtained with typical carboxylic acids as also with some sulphonic and arsonic acids.

Chemical Laboratories, L. N. MULAY.
The Institute of Science, R. M MATHUR.
Bombay,
March 28, 1951.

1. Karrer, *Organic Chemistry*, 1947, **621**. Schmidt, *Organic Chemistry*, 1936, 454. Clarke, *Handbook of Organic Analysis*, 1936, 142. Weston, *Carbon Compounds*, 1923, 16, 29, 40 and 42. Dyson, *Manual of Organic Chemistry for Advanced Students*, 1950, **1**, 321. Huntress and Mulliken, *Identification of Pure Organic Compounds*, 1946, 146 & 164. 2. Perkin and Kipping, *Organic Chemistry*, 1937, **1** & **2**, 432. 3. Bernthsen and Sudborough, *Organic Chemistry*, 1944, 564. 4. Bargellini and Marantonio, *Atti. R. Acad. Lincei*, 1908, **17ii**, 119. 5. Riedel and Haen, *Ger*, 1930, **544**, 893 (*cf. C.A.*, 1931, **25**, 2736). 6. Braun, Anton and Meyer, *Ber.*, 1941, **74B**, 1772. 7. Badre and Vieles, *Bull. Soc. Chim.*, France, 1947, 825. 8. Ewaldo Curlin, *Anais. Assoc. quim Brasil*, 1942, **1**, 88.

A NEW SYNTHESIS OF DIBENZOTHIOPHENE

DIBENZOTHIOPHENE (I) occurs in coal-tar together with crude phenanthrene and is used as a dyestuff intermediate and also in the synthesis of physiologically active compounds. Several syntheses of (I) have been reported. The new method, which has now been developed for the preparation of (I), is similar to the synthesis of 2- and 2:3-dimethylbenzo- and naphthothiophenes described recently by Werner.[1]

Condensation of thiophenol with 2-bromocyclohexanone in presence of alcoholic sodium ethoxide in boiling water-bath gave 2-phenylmercaptocyclohexanone (II). It gave colourless oil on distillation, b.p. 152-3° (bath temp.)/10 mm. (yield, 77%) (Found: C, 69·7; H, 6·5. $C_{12}H_{14}OS$ requires C, 69·9: H, 6·8%). 2:4-Dinitrophenylhydrazone from (II) crystallized from alcohol-ethyl acetate in yellow needles, m. p. 162-3° (Found: C, 56·6: H, 5·1: N, 14·1. $C_{18}H_{18}N_4O_4S$ requires C, 56·0: H, 4·7: N, 14·5%).

Treatment of (II) with phosphorus pentoxide at 170-80° yielded 1:2:3:4-tetrahydrodibenzothiophene (III), which gave a colourless oil on distillation, b. p. 141° (bath temp.)/10 mm. (yield, 74%) (Found: C, 76·6; H, 6·5. Calc. for $C_{12}H_{12}S$: C, 76·6: H, 6·4%). The compound has been reported earlier being prepared by the Clemmensen reduction of 1-*keto*-1:2:3:4-tetrahydrodibenzothiophene.[2] The picrate from (III) crystallized from absolute alcohol in orange needles, m.p. 108-9° (Found: N, 9·6. $C_{18}H_{15}N_3O_7S$ requires N, 10·1%).

Dehydrogenation of (III) by selenium[3] at 300° for 22 hours gave a 91% yield of dibenzothiophene, m. p. 96-8°. After recrystallization from alcohol, it gave elongated colourless needles, m.p. 98° (*cf.* Literaure[3,2] m. p.'s 99° and 95-6°) (Found: C, 77·8. H, 4·5. Calc. for $C_{12}H_8S$: C, 78.3: H, 4·4%). The picrate from (I) gave fine yellow needles, m. p. 123-4° from absolute alcohol; Gilman and Jacoby[3] give m.p. 125° (Found: N, 10·3. Calc. for $C_{18}H_{11}N_3O_7S$: N, 10·2%).

A few 4-substituted derivatives of (I) have been prepared through metalation[3] and 2- and 2:8-disubstituted derivatives are obtainable by direct substitution.[3,4] With the exception of these compounds, other derivatives of (I) are not readily accessible. Starting from arylthiols and substitued 2-bromocyclohexanones, new substituted derivatives of (I) as well as its higher polycyclic derivatives may now be synthesized by the above method. Similarly by using bromotetralones in place of 2-bromocyclohexanone, other sulphur-containing polycyclic ring systems could also be built up. Work on these lines is in progress.

Dept. of Chem. Technology, K. RABINDRAN.
University of Bombay, B. D. TILAK.
Matunga Road, Bombay 19,
May 8, 1951.

1. Werner, *Rec. trav. chim.*, 1949, **68**, 509 (cited from *C. A.*, 1950, **44**, 1093.) 2. Gilman and Jacoby, *Ber.*, 1943, **76 B**, 1269. 3. Buu Hoi and Cagniant, *J. Org. Chem.*, 1938, **3**, 108, 120. 4. Courtot, *et al.*, *Compt. rend.*, 1926, **182**, 931; 1928, **186**, 1624; Cullinane, *et al.*, *J.C.S.*, 1936, 1435; Neumoyer and Amstutz, *J.C.S.*, 1947, **69**, 1920; Brown, *et al.*, *ibid.*, 1948, **70**, 1748; Gilman and Nobis, *ibid.*, 1949, **71**, 274.

CHEMICAL INVESTIGATION OF THE GUM FROM DRUM-STICK PLANT *MORINGA PTEROSPERMUM*

ROUTINE analysis of the purified gum indicated the following composition:— Ash 0·3%: pentoses 50·2%; methyl-pentoses 0·5%; cellulose 5·3%; hexo-uronic acid 11·9% and galactose (by difference, as the yield of mucic acid was low) 31·8%.

After hydrolysis of the gum by 3% sulphuric acid the reducing sugars were removed by alcohol, and the barium salt of uronic acid was isolated in a pure condition. This barium salt on oxidation with nitric acid, gave mucic acid and saccharic acid. The

further hydrolysis of the salt gave galactose m.p. 162° C., $\alpha = +78{\cdot}5$. The barium percentage in the salt indicated that the acid might be composed of two galactose and one glucoronic acid units. The structure of this acid is being worked out.

Examination of the sugars produced by the hydrolysis of the gum on the paper chromatogram indicated the presence of galactose, arabinose and a methyl-pentose. The Rf value of the methyl-pentose agreed very well with that of rhamnose. The chromatogram was developed by the modified procedure of Trevelyan, Procter and Harrison.[1] It was found that the same procedure could be used for identifying polyhydric alcohols like mannitol.

Maharaja Pratapsigh Chem. Laboratory, S. P. College, Poona 2, *June* 10, 1951.

T. R. Ingle.
B. V. Bhide.

1. Trevelyan, Procter and Harrison, *Nature*, 1950, **166**, 444.

OCCURRENCE OF THE GENUS *ATYA* LEACH (CRCUSTACEA: DECAPODA: ATYIDAE) IN THE INDIAN MAINLAND*

So far only two genera of the primitive family Atyidæ have been known from the Indian mainland. Of these two, *Caridina* is very extensively distributed in Indian waters and is represented by a number of species, while the other genus has got only one Indian species *Paratya curvirostris* (Heller) recorded by Kemp[1,2] from Tezpur (Darrang District) and Manipur Hills in Assam. There is, as yet, no record of the occurrence of *Atya* from India, although Kemp referred to "a few specimens from the Andamans" and "a single specimen from Ceylon" as belonging to this genus. Kemp had, however, not given specific identity of these specimens. In addition Reux[3] has recorded *Atya moluccensis* de Haan from Burma and Ceylon and he also considered Kemp's Andamanese and Ceylonese specimens as perhaps belonging to this species.

Recently, Mr. A. G. K. Menon has brought a small collection of freshwater decapod crustaceans from Koraput Hills, Orissa, which contains three good specimens of the genus *Atya*. On examination these proved to belong to *Atya moluccensis*. Kemp's Andamanese specimens, also were found to belong to the above-named species. The Indian and the Andamanese examples, however, differ in some respects from the typical Malayan form. A detailed report on these, along with other material of *Atya* preserved in the collections of the Zoological Survey, will be published at a later date.

The discovery of *Atya moluccensis* in the Indian region extends the range of this species further westwards and furnishes yet another evidence of the close affinity between Indian and Malayan faunas.

Zoological Survey of India, 34, Chittaranjan Avenue, Calcutta 12, *April* 20, 1951.

K. K. Tiwari.

* Published with the permission of the Director, Zoological Survey of India, Calcutta.

1. Kemp, S., *Rec. Ind. Mus.*, 1917, **13**, 303. 2. —, *Ibid.*, 1912, **7**, 114. 3. Roux, J., *Nov. Caledonia*, 1925, **4**, 218.

LEAD ANAEMIA OF THE RABBIT AS A TEST FOR THE POTENCY OF LIVER EXTRACTS

N. Gerlich[1] reported a method for the determination of the anti-anæmic potency of liver extracts. The method determines the amount of liver extract necessary to prevent a drop in R.B.C.s and Hb, which invariably follows intravenous injection of 3 daily doses of lead-acetate (5·5–6 mg. per kg. body weight) in rabbits of 2·5 kg. weight. The author reports that liver extracts inactivated by autoclaving were ineffective.

The question was therefore examined whether or not vitamin B_{12} counteracts Gerlich's lead-anæmia, because factors other than B_{12} may detoxify and be inactivated by autoclaving.

Three rabbits of 1·5 kg. all from the same parents, made anæmic with identical doses of lead acetate (Haffkine Institute strain) received therefore 3 μg, 6 μg, and 9 μg, B_{12} each. From Table I it may be seen that increased doses result in an increased R.B.C. count.

Table I

Single Dose B_{12} by vein	Rabbit No.	Increase in R.B.C.s in millions			
		3rd day	5th day	7th day	9th day
3 μg ..	3	1·0	1·5	1·6	1·2
6 μg ..	5	1·3	1·7	2·0	1·6
9 μg ..	2	1·6	2·0	2·6	2·3

The R.B.C. counts were all near 3 millions before administration of B_{12}. It appears thus

that not only the protecting influence of various doses of liver extracts, but also the direct increase in R.B.C.s can be used, if the maximal increase, which in our animals occurred on the 7th day, is determined. Further work is in progress.

We thank Mr. W.T. Suren and Dr. B.K. Nandi, Chief Chemist and Manager of Messrs. Teddington Chemical Factory Ltd., for their kind permission to carry out this work.

Research Department,
Teddington Chem. Factory Ltd.
Andheri, Bombay, F. W. VAN KLAVEREN.
June 25, 1951. P. C. SHRIVASTAVA.

1 Gerlich, N., *Arch. Exp. Path. u. Pharmakol.*, 1950, **90**, 211.

PHOTOPERIODIC RESPONSE IN SOME EARLY VARIETIES OF PADDY

DIFFERENT varieties or strains of paddy in the various localities of India have been reported to show marked contrast in their day-length requirement.[1-7] In the present communication the photoperiodic response in four early varieties of paddy grown in U. P. is reported. Pure seeds of the four early varieties, T. 136, T.N. 22 (*Rajbhog*), T.N. 27 (*Banki*), and Ch. 10 (*Tandwa White*) after being sterilized in 0·2% formalin solution were sown in earthenware pots, 11″ × 10″, filled with a mixture of well pulverised garden loamy soil and cow dung manure in the proportion of 8 : 1. Eighteen days after sowing, the 10-hour short-day (8 A.M. to 6 P.M.) and the 24-hour long-day (extra light supplied from a 1,000 watt 'Osram' gas-filled bulb) treatments were begun. Five treatments including the control with 6 pots in each were employed; in all there were 120 pots in this investigation. Each pot had 4 plants. The results are presented in Table I.

A study of the results in Table I shows that the application of short photoperiods of 10 hours induces a significant delaying effect in both the experimental sets. The degree of delaying effect is dependent on the duration of the treatment, maximum delay being observed by continuing the treatment till the time of ear emergence. An exposure of seedlings for 30 days induces a delaying effect of 5-9 days depending on the particular variety used, whereas delay of earing was 8-15 days when the treatment was continued until heading. In the light of these findings, Kar's statement[2] that in different varieties of paddy warm temperature associated with short day-length is inducive to earliness and cold temperature or longer day-lengths produce retardation, needs modification. In these four early varieties of paddy grown throughout their life period under the naturally prevailing high temperature, short days did not induce earliness but rather they have greatly prolonged the time of ear emergence.

The other interesting result of this investigation is that in the experimental set where the short days were prolonged until heading it was noted that in about 50% of the total plants in varieties T. 136 and T. N. 22, in 41·6% of the plants of variety T.N. 27 and in 21% of the plants in variety Ch. 10, the ears of the main shoot did not come out of the boot. On dissection of the culms in these cases it was observed that although the ears were formed, their growth was arrested inside the boot. Thus the effect of the prolonged short-day treatment may be resolved into two groups (*a*) delay in the ear emergence and (*b*) total suppression of the emergence of ear of the main shoot. The suppression of the emergence of ear of the main shoot in a certain percentage of the plants and not in the entire population was possibly due to the fact that these plants

TABLE I

Showing the days from sowing to first panicle emergence. Sowing date May 7, 1949; Treatment begun May 25, 1949. + indicates induced earliness.— indicates induced delaying effect.

Treatments	(Average time in days from sowing to ear emergence)				Difference from control in days			
	T. 136	T.N. 22	T.N. 27	Ch. 10	T. 136	T.N. 22	T.N 27	Ch. 10
A. Control ..	90·68	88·30	87·18	90·43	..	..	..	..
B. Short-day treatment for 30 days ..	97·13	96·60	94·96	95·61	−6·45	− 8·30	− 7·78	− 5·18
C. Short-day treatment prolonged till ear emergence	98·95	102·87	100·50	102·00	−8·27	−14·57	−13·32	−11·57
D. Long-day treatment for 20 days ..	91·08	90·26	..	..	−0·40	− 1·96	..	..
E. Long-day treatment for 30 days ..	93·11	90·61	..	..	−2·43	− 2·31	..	..

might not have reached the same developmental stage as the others to react to the photoperiodic stimulus in a similar manner. Detailed histological and micro-chemical tests of the culms below the arrested spikelets might throw more light as to why the stem elongation was inhibited in those cases. One of the possible reasons for this irregularity might be assigned to the fact that although the entire stock of the grains used in this experiment were pure varieties, it might be a mixture of a number of physiologically different strains so far as their reactions towards the prolonged short-day photoperiod are concerned. From the results of this experiment and of the previous workers it appears that the response of paddy varieties to photoperiodic treatment is of varietal character.

Grateful thanks are due to Prof. Shri Ranjan for his useful suggestions and guidance and the facilities provided by him in the Botanical Laboratory of the Allahabad University for carrying out this piece of investigation.

Department of Botany, GADADHAR MISRA.
Ravenshaw College,
Cuttack 3,
February 28, 1951.

1. Kar, B. K. and Adhikari, A. K., *Sci. and Cult.*, 1944-45, **10**, 506. 2. Kar, B. K., *Nature*, 1946, **157**, 811. 3. Misra, G., *Curr. Sci.*, 1950, **19**, 126. 4. Saran, A. B., *Jour. Ind. Bot. Soc.*, 1945, **24**, 153. 5. Sircar, S. M., *Nature*, 1944, **153**, 378. 6. —. and Parija, B., *Ibid.*, 1945, **155**, 395. 7. —, and Ghosh, B. N., *Ibid.*, 1947, **159**, 605.

ON A NEW SPECIES OF NYCTOTHERUS FOUND IN *UPERODON SYSTOMA* SCHNEIDER MICROHYLIDÆ

THE only ciliate so far reported from *Cacopus systoma* (Schn.) is *O. japonica* Sugiyama, which Metcalf observed in two frogs of Microhylid genus from Madras.[1]

In the present note a new species of *Nyctotherus* found in one of the four adults (each measured 40 cm. from snout to vent) of *Cacopus systoma* (Schn.), from Dharwar, is described. Also, a record is made of ciliates such as *Balantidium helenæ* Bez., *Nyctotherus cordiformis* Stein., and *Opalina obtrigonoidea* lata Nie., found associated in the rectum with the new species for the first time.

The characteristic features of the new species, named as *N. cacopusi*, are: (1) the club-shaped macronucleus, (2) the cytostome placed towards the anterior pole of the body, (3) the straight but obliquely placed cytopharynx, and (4) the angular position of both the macronucleus and the cytopyge.

The smears were fixed with Bouin's fluid and stained with Delafield's Hematoxylin. All the figures have been drawn with the aid of a camera lucida.

Nyctotherus cacopusi nov. sp.

Measurements in microns.—Body (length × breadth) 465 × 350; macronucleus (length × breadth) 170 × 55; micronucleus, oval (length × breadth) 30 × 20; nuclear angle 65°; shortest distance between the anterior pole of the body and the macronucleus 80; breadth of cytostome 35; anal angle 60°.

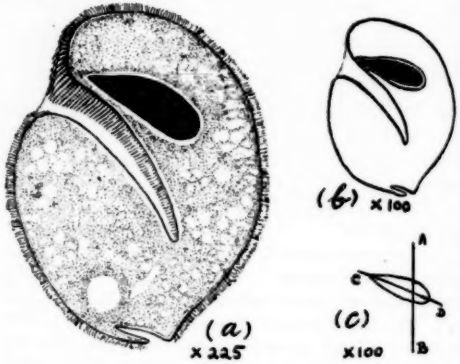


FIG. 1. (*a*) *Nyctotherus cacopusi* nov. sp., from *Cacopus systoma* (Schneider).
(*b*) The same under the low power of microscope.
(*c*) Shows the angle made by the macronucleus to the principal axis of the body. The line AB represents the principal axis and CD is the line joining the anterior and posterior poles of the macronucleus.

Morphology: Body of organism bean-shaped. The two body poles, namely, the anterior and the posterior, appear somewhat narrow and bluntly rounded. The cytopharynx opening near the anterior pole extends downwards into the cytoplasm in the form of a narrow straight tube somewhat obliquely placed; and ends more or less in the middle of the posterio-dorsal portion of the body. The large club-shaped macronucleus situated immediately over the cytopharynx is characteristic. Its narrow and pointed club-end, facing the ventral side of the body is nearly touching the cytopharynx, while its opposite posterior end is broad and bluntly rounded. A noticeable feature in this *Nyctotherus* is the large, oval and distinct micronucleus usually found in the mid-ventral region of the macronucleus. Food vacuoles and

	N. magnus	*N. vorax*	*N. cochlearis*	*N. cacopusi* n. sp.
Body shape and size ..	Kidney-shaped 660 length	Globular 450 × 250	Shell-like 430 × 335	Bean-shaped 465 × 350
Nucleus ..	Flat and irregular	Ovoidal 100 × 75	elliptical 235 × 40	Club-shaped 170 × 55
Cytopharynx ..	Recurved at end	Circular	Circular	Obliquely straight
Nuclear angle ..	..	65°	48°	65°
Anal angle ..	..	..	63°	60°

granules were found distributed in the cytoplasm both in the anterior and posterior portions. A thin ectoplasm below the pellicle appeared more granulated than the endoplasm. Close to the periphery of the posterio-ventral side of the body an excretory vacuole was usually present. The cytopyge is found at the posterior pole of the body. The cilia over the body are small and fine. Those on the cytopharynx are specially long and thick.

The above table shows how the four giant species of *Nyctotherus* differ from one another: —

The revised list of ciliates so far known from *Cacopus systoma* (Schneider) is as follows: —

1. *Opalina japonica* Sugiyama.,
2. *Opalina obtrigonoidea* lata Nie.,
3. *Nyctotherus cacopusi* nov. sp. mihi.,
4. *N. cordiformis* Stein.,
5. *Balantidium helenæ* Bez.

Department of Zoology,
Karnatak College, J. C. UTTANGI.
Dharwar,
May 3, 1951.

1. Metcalf, M. M., *Proc. U.S. Nat. Mus.*, 1940, **87**, 465-64. 2. Uttangi, J. C., *Curr. Sci.*, 1948, **17**, 325-26.

INDIA INK AS A SEMEN STAIN

IN an effort to find a suitable substitute for Opal blue (Bresslau) as a semen stain, a large number of stains in various formulas were tried with little success. Two brands of India ink were found to be satisfactory—Higgins brand, an American make and Reeves brand, a British make. The semen of a large number of farm animals including the bull, buffalo, ram, buck, boar, stallion, jack and the rooster, was used in this study. The technique of staining consists of rapidly and thoroughly mixing a drop of semen and a drop of India ink together for a few seconds and making smears from this semen-stain mixture. The entire staining process is completed in a few seconds and smears are ready for examination in less than one-half minute. The smears should be neither too thick nor too thin, a properly made smear presenting a deep brown to a blackish brown appearance to the naked eye. In such preparations the India ink supplies the dark background against which the unstained sperm appear as whitish structures. This is an excellent method for demonstrating the cytoplasmic drops which, when present, appear as shining white globules. The several morphological features of spermatozoa are clearly brought out to enable a gross morphological study. Since opal blue is not available in this country at present, India ink can be used instead in artificial insemination work for the study of sperm morphology.

There is not much to choose between the two brands of India ink used in this investigation. Smears made by this technique remain in excellent condition without fading for a period of three years in the author's experience and probably much longer. No special precautions are necessary for the storage of India ink.

Dept. of Animal Husbandry,
Madras Veterinary College, C. KRISHNA RAO.
Vepery, Madras,
May 25, 1951.

CHROMOSOME NUMBERS OF SOME WILD CUCURBITS

THE members of the genus *Melothria* have a wide distribution and are known to occur in South America, S. Africa, Australia and Asia. They occur wild and do not belong to the cultivated group of cucurbits. The genus comprises 69 species of which chromosome numbers of three species,[1] namely *Melothria Japonica* $2n = 22$, *M. punctata* (*abyssinica*) $2n = 24$ and *M. scabra* $2n = 24$ have been reported. Some species of this genus occur in India of which four species, *viz.* *M. maderaspatana*, *M. leiosperma*, *M. perpusilla*, and *M. heterophylla* are are found in the Bombay State. The chromosome numbers fo these four species have been determined and are reported here.

Darlington and Janakiammal[1] give the basic number (x) of this genus as 11 and 12. *M. japonica* with $2n = 22$ belongs to the group

	Name		n	$2n$	Sex type	Ploidy	Chromosome numbers determined by
1	*Melothria japonica* Maxim	..	11	22	Monœcious	Di-ploid	Nakajima
2	*M. scabra* Naud.	..	12	24	Diœcious	do	Kozhuchow
3	*M. maderaspatna* Cogniaux	..	11 or 11+1−2 fragment	22 or 22+1−2 fragment	Monœcious	do	Kumar and Vishweshwara
4	*M. leiosperma* Cogniaux	..	12	24	do	do	do
5	*M. heterophylla* Cogniaux	..	24	48	Diœcious	Tetraploid	do
6	*M. punctata* (*abyssinica*) Cogniaux		12	24	do	Di-ploid	McKay
7	*M. perpusilla* Cogniaux	..	24	48	Monœcious	Tetra-ploid	Kumar and Vishweshwara

with 11 as basic number and *M. punctata* and *M. scabra* belong to the second group with 12 as basic number. Among the species represented in the Bombay State, types belonging to both the basic numbers are observed as shown in the table given above.

From a cytological study of the species occurring in the Western Ghats of the Bombay State, it is observed that there is a polyploid series within the genus. Of the species so far reported they belong either to the diploid with $2n = 22$ or 24 and tetraploid with $2n = 48$. Further studies on the interrelationships of the species occurring in the Western Ghats are in progress and will be reported elsewhere.

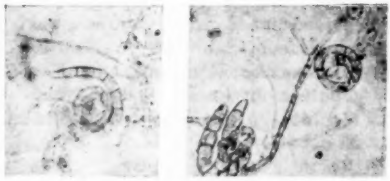
Cytological Laboratory, L. S. S. KUMAR.
College of Agriculture, S. VISHVESHWARA.
Poona 5,
May 30, 1951.

1. Darlington and Janakiammal, *Chromosome Atlas of Cultivated Plants*, 1945.

GENUS *HELICOCERAS* LINDER, NEWLY REPORTED FROM INDIA

THIS fungus was isolated from dead wood of *Cassia sumatrana* Roxb. Small wood pieces from the shoot of a dead tree were externally sterilised with conc. borax and ·01% mercuric chloride solutions and kept in sterilised moist chamber. After about a week the pieces which had developed a small violet mycelium on them were transferred to standard synthetic agar slants where a copious dark mycelium developed within three days.

The fungus grew well in culture medium and presented a dark appearance but the cultures could not survive in winter. Examination of the mycelium reveals that it is a typically dematiaceous fungus with long, slender and coiled conidia characteristic of helicosporous *Fungi Imperfecti*. The hyphæ are dusty hyaline about 3·5 μ thick, irregularly branched and septate—septa being about 15-20 μ apart. Conidia are more or less in bunches each conidium being dusty hyaline and coiled. They are slender, about 6·7 μ wide but their total length and other characters, *viz.*, number of septa, number of times the conidium is coiled, varied. The majority are 60-70 μ long and have 1½ coils and 10-13 septa.



FIGS. 1, 2. Photomicrographs of *Helicoceras oryzae* showing conidia, × 275.

The characters show that it is a member of helicosporous *Fungi Imperfecti*. The fungus slides were sent to the Commonwealth Mycological Institute, Kew, and it has been identified as *Helicoceras oryzeæ* Linder and Tullis which has been recorded by Tullis[1] from Chinese rice in U.S.A.

This appears to be the first record of the genus *Helicoceras* Linder which Linder[2] created in 1931 and also the first record of a member of helicosporous *Fungi Imperfecti* from India.

Thanks are due to Mr. S. J. Hughes of the Commonwealth Mycological Institute, Kew, for the specific identification of the fungus.

Botany Dept., DAYA NAND PANT.
Lucknow University,
Lucknow,
May 30, 1951.

1. Tullis, E. C., *Tech. Bull. U.S. Dept. Agric.*, 1936, **11**, 540. 2. Linder, D. H., *Ann. Missouri Bot. Gdns.*, 1931, **18**, 1-8.

ABNORMAL SPIKE OF *HELMINTHOSTACHYS ZEYLANICA* L.

Helminthostachys zeylanica L. is found plentiful in Burma, Assam and Ceylon. Normally the barren segment is palmately pinnate and there are three principal divisions. Each division has two pinnæ and rarely one of the lateral divisions bears three pinnæ. The fertile spike is solitary and unbranched.

A specimen collected in the Buxa Duars of North Bengal however showed some peculiarities in the barren segment and also in the spike.

The barren segment has three principal divisions. One of the lateral divisions bears three pinnae and the central division instead of having two pinnae, has five pinnae. The rachis gives off a second pair of lateral branches and finally ends in a terminal pinna.

Normally when the rachis branches it does so dichotomously and one of these branches again bifurcates resulting in three pinnæ. This is the condition in one of the lateral divisions, whereas the central division has its rachis bearing lateral branches.

The fertile spike, which is normally unbranched, is forked in the specimen. The forking takes place from the middle of the spike. Bower[1] refers that the spike of Helminthostachys is often subjected to accessory branchings, and according to him the branching may be combined with correlative vegetative growth where sporangia are absent. But, in the specimen under consideration, the branching of the spike and the branching of the rachis of the barren segment run parallel. The sporangia are quite normal with spores in them.

In specimens where only one of the lateral divisions bears three pinnæ the spike is unbranched and shows no indication whatsoever of branching.

The author expresses his gratitude to Dr. T. S. Mahabale for scrutinizing the manuscript and his valuable suggestions thereon.

Botany Department, M. Banerji.
Meerut College,
Meerut,
June 4, 1951.

1. Bower, F. O., *The Ferns* (*Filicales*) *Camb. Bot. Handbook*, 1926, 2.

NOMENCLATURE OF BACTERIAL PLANT PATHOGENS

Ever since the discovery by Burrill in 1878, that the bacteria can cause plant diseases, there has never been concord amongst the phytopathogenic bacteriologists on the nomenclature of this important group. Although the workers in this field suggested several generic names, the following are now mentioned in Bergey's Manual[1]: *Xanthomonas*, *Agrobacterium*, *Erwinia*, *Pectobacterium*, *Corynebacterium*, *Pseudomonas* and *Bacterium*. Of these, the first 4 are exclusively assigned to phytopathogenic bacteria. The genus *Corynebacterium* as recommended by Dowson to replace *Aplanobacter* of Smith should be rejected since the latter name was specially suggested by him for the non-motile, gram-positive plant pathogens. The genus *Pseudomonas* includes organisms in pus, soil, water, etc., and should, therefore, not be used for the plant pathogens. This genus has recently been split up into 2[2], *viz.*, *Pseudomonas* and *Phytobacterium*, the latter to include non-green fluorescent phytopathogenic organisms. Dowson includes *Agrobacterium*, *Erwinia* and *Pectobacterium* under *Bacterium*, a heterogeneous group and therefore should be rejected. The writers suggest that a new family called Phytobacteriaceae be erected to include only the phytopathogenic bacteria and the following genera based on the types of symptoms produced, thus lessening confusion. This system is a natural one since it facilitates quick diagnosis and brings generally to the mind the types of symptoms each genus produces besides showing relationship at a glance, and thus proving the change more convenient and useful. The description of the new family and the new genus together with 6 other accepted genera and the typical symptoms produced by each are given below:—

Phytobacteriaceae nov. fam.

Organisms yellow, white, green-fluorescent or variant; short or long rods; motile with monolopho or peritrichiate flagella or non-motile; mostly gram-negative; a small number gram-positive. No endospores. Capsulated or otherwise; not acid-fast; not attacking celiulose; indol production nil or slight; aerobic; dextrose fermented with or without gas. Optimum temperature for growth 20-30° C., max. 37° C. with thermal death point never exceeding 52° C. Plant pathogens causing leaf-spot, canker, soft rot, gall, wilt or blight.

Genera

1. *Chlorobacter* nov. gen.
syn. *Pseudomonas* (Partly) Migula emend Dowson

Organisms producing green fluorescent water-soluble pigment; 1 to several polar flagella; gram-negative; mostly entering hosts through natural openings; gelatin generally liquefied;

starch hydrolysed; non-lipolytic; acid but no gas in several mono and di-saccharides; salicin not fermented; M.R. and V.P. tests negative. Plant pathogens primarily producing leaf-spot and canker of leaves, stems, fruits and branches, rarely blight.

Type sp.—*Chlorobacter syringæ* (van Hall) nov. comb.

2. *Phytobacterium*[2] Magrou and Prevot
syn. *Pseudomonas* (Partly) Migula emend Dowson

Same as 1 above, except that the organisms are white; not fermenting lactose.

Type sp. *P. fabae* (Yu) Magrou and Prevot

3. *Xanthomonas* Dowson
Water insolube yellow pigment producing organisms, causing leaf spot, canker and rarely blight.
4. *Agrobacterium* Conn.
Causing hypertrophy.
5. *Erwinia* Winslow, *et al.* emend Patel and Kulkarni
Causing blight.
6. *Pectobacterium* Waldee
Causing soft rot.
7. *Aplanobacter* Smith emend Patel and Kulkarni (syn. *Corynebacterium* Lehmann and Neumann)
Causing wilt.

Grateful acknowledgement is made to Drs. B.B. Mundkur and M. J. Thirumalachar for valuable suggestions. A detailed paper giving reasons for such a change in the nomenclature of the phytopathogenic bacteria will shortly be published.

Plant Path. Laboratory, College of Agriculture, Poona 5,
June 6, 1951.

M. K. PATEL.
Y. S. KULKARNI.

1. Bergey, *et al.*, *Manual of Determinative Bacteriology*, 1948, 6th ed. 2. Magrou Joseph and Andre R. Prevot, *Compt. Rend. Acad. Sci.* (Paris), 1948, **226**, 1229–30.

AXIAL GRADIENT IN THE WATER CONTENT OF THE BODY-WALL OF EARTHWORMS

IT has been well established that different regions of the body of Oligochætes are not on the same physiological level and that they exhibit a kind of gradient pattern in their metabolism, behaviour, responses, etc., which has been termed by Child[1] as an "U-shaped" gradient pattern—'a convenient designation for a gradient pattern in the longitudinal axis with two high ends and a low region between them[1]' (p. 120).

So far the evidence for the existence of such a gradient pattern is based on: (*i*) differences in the oxygen uptake and CO_2 production of pieces of body-wall from different regions of earthworms[2–7]; (*ii*) differences in the rate of dye-reduction at different body-levels of earthworms and microdilous oligochætes[8,9]; (*iii*) differential susceptibility in microdilous oligochætes[10]; (*iv*) electro-potential,[12] and galvanotactic reactions[13], and effects of heat shortening at different body levels[14] of earthworms.

Attention was drawn by Hatai[14] to another feature which also showed the U-shaped gradient pattern, but of the inverted type, *i.e.*, with two low ends and a high region between them. He found a difference in the water content of small pieces of the body wall from different regions of the body of earthworms, *Pheretima* (= *Perichæta*) *divergens* and *P. megascolidioides*; (Fig. 1, D, E). The investigations of Kopenhaver[15] also showed the presence of a gradient pattern in this respect in *Lumbricus terrestris* and *Helodrilus* (=*Allolobophora*) *caliginosus*, but this gradient was markedly different from that found by Hatai in that there was a regular antero-posterior increase in the percentage of "free" or "unbound" water in the body wall of the species examined (Fig. 1, C, F). In view of these divergent results obtained by Hatai and Kopenhaver, a re-investigation of this problem was undertaken.

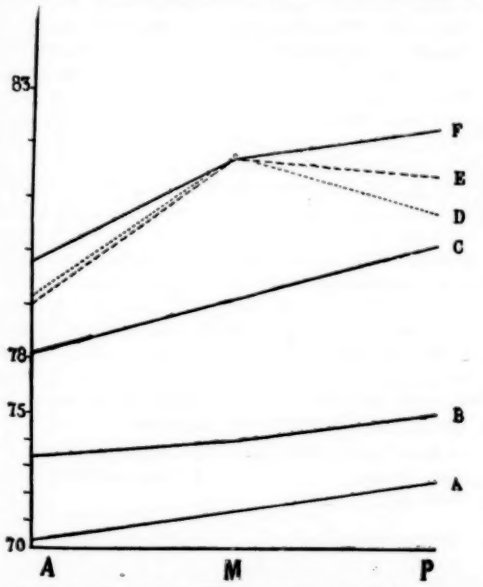
Estimations of the water content of approximately equal pieces of the body wall, consisting of 15-20 segments, from different regions, preclitellar, slightly post-clitellar and rectal, of *Pheretima posthuma* and *Lampito* (= *Megascolex*) *mauritii* were carried out by desiccating them over sulphuric acid, as was done by Kopenhaver, and, also, by drying them in a hot air oven at 100° C. for 3–4 hrs., in which time the weight became constant and remained so for over 17 hrs.

Six of the results, out of a series of twelve consistent estimations, for each worm by each method, are given in Table I as percentage of water in 100 gm. of tissue. The results, by both the methods, exhibit a regular antero-posterior increase in the water content of the body-wall (Fig. 1, A, B).

The present results agree with the results of Kopenhaver and, for this feature, we can almost be certain of the existence of this particular type of gradient pattern in all earthworms.

TABLE I
(as grammes of water in 100 gm. of body wall)

	Dried over sulphuric acid			Dried at 100° C.		
	Anterior	Middle	Posterior	Anterior	Middle	Posterior
Pheretima posthuma						
1	75·33	76·05	76·69	76·28	76·38	78·02
2	72·21	73·24	74·96	73·40	73·57	75·27
3	73·71	74·12	76·50	72·24	73·39	74·10
4	73·46	73·91	74·65	73·55	73·90	74·37
5	73·31	73·34	73·59	71·54	73·35	74·04
6	71·32	72·96	73·36	73·16	73·45	74·19
Average	73·22	73·93	74·95	73·36	74·00	74·99
Lampito mauritii						
1	71·67	73·60	74·02	75·75	76·61	77·94
2	72·83	73·03	73·52	70·78	71·73	72·93
3	73·99	74·33	75·90	69·75	70·06	70·96
4	72·48	73·05	73·88	69·74	70·90	72·03
5	69·55	70·80	71·53	68·33	69·96	71·15
6	69·75	70·76	71·37	67·12	68·73	70·00
Average	71·71	72·59	73·37	70·24	71·33	72·50



Amount of water in 100 gm. of body wall from the anterior, middle and posterior regions of the body of earthworms.

A, *Lampito mauritii*; B, *Pheretima posthuma*; C, *Helodrilus caliginosus*; D, *Pheretima divergens*; E, *P. megascolidioides*; F, *Lumbricus terrestris*.

Since a species of the genus *Pheretima* also has now been shown to possess the anteroposteriorly increasing gradient pattern, the difference in the manner of growth of *Pheretima* on one hand and *Lumbricus* and *Helodrilus* on the other, which was suggested by Kopenhaver to account for the different results obtained by herself and Hatai, cannot be held valid. At the same time the other cause, namely, the difference in the methods of estimations, also cannot be held to account for the difference, as one set of estimations in the present investigation was by a method identical with the one employed by Hatai and the results obtained by it agree with those obtained by drying over sulphuric acid.

It will be observed from Fig. 1 that the water content of each region of *P. posthuma*, and also of *L. mauritii*, is appreciably lower than that of the corresponding region of *P. divergens* and *P. megascolidioides*, as well as those of *L. terrestris* and *H. caliginosus*, indicating that the integument of the Indian (Lucknow) worms is drier than that of the Japanese and American ones. This may, probably, be due to the general dry conditions of the earth in India as compared with that in Japan and Illinois, U.S.A.

The author is thankful to Professor K. N. Bahl, under whose guidance this work was done, for critically going through the manuscript and his constant encouragement.

Department of Zoology,
University of Lucknow, B. K. TANDAN.
Lucknow,
June 9, 1951.

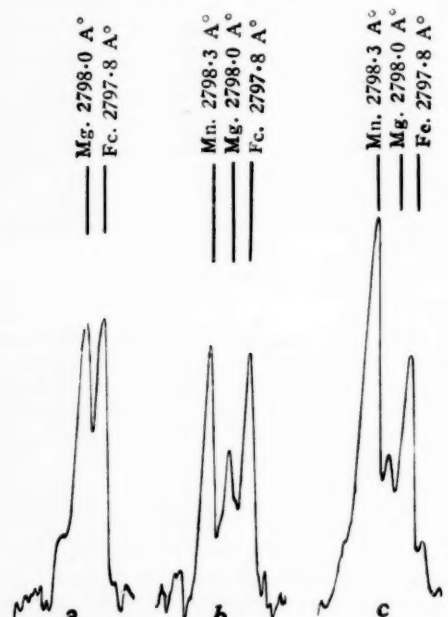
1. Child, C. M., *Patterns and Problems of Development*, 1941, Chicago University Press, Illinois. 2. Hyman, L. H., and Galigher, A. E., *Jour. Exp. Zool.*, 1921, **34**. 3. Shearer, C., *Proc. Roy. Acad.*, 1924, **96**. 4. Perkins, M., *Nature*, 1929, **124**. 5. Okada, T., *Dobutsugaku Zasshi*, 1929, **38**, (in Japanese). 6. Kawaguti, S., *Mem. Fac. Sci. Taihoku Imp. Univ.*, 1934, **7**. 7. Watanabe, Y., *Sci. Repts. Tohoku Imp. Univ.*, 1931, **6**. 8. Child, C. M., and Rulon, O., *Jour. Exp. Zool.*, 1936, **74**. 9. Child, C. M., *Proc. Soc. Exp. Biol. Med.*, 1934, **32**. 10. Hyman, L. H., *Jour. Exp. Zool.*, 1916, **20**. 11. Morgan, T. H., and Dimon, A. C., *Ibid.*, 1904, **1**. 12. Watanabe, Y., *Sci. Repts. Tohoku Imp. Univ.* Ser., 4, 1928, **3**. 13. Moore, A. R., and Kellogg, F. M., *Biol. Bull.*, 1918, **30**; and Moore, A. R., *Jour. Gen. Physiol.*, 1923, **5**. 14. Hatai, S., *Sci. Repts. Tohoku Imp. Univ.*, Ser. 4, 1926, **1**. 15. Kopenhaver, M., *Physiol. Zool.*, 1937, **10**.

EFFECT OF MANGANESE ON THE INTENSITY OF MAGNESIUM LINES IN A DIRECT CURRENT ARC SPECTRUM

IT is well known that great care is necessary in the selection of suitable lines for the quantitative estimation of an element, as one constituent may have considerable effect on the spectral line intensities of other constituents in a soil matrix. While investigating the conditions (using H. S. copper electrodes) suitable for the quantitative estimation of manganese in soils, a suppression in the intensity of a magnesium line is observed and the preliminary results are given below.

The moderately intense lines, 2801·1 Å., 2798·3 Å, of manganese were often used for the quantitative measurements by earlier investigators[1,2,3]. Among these two, the line 2798·3 is free from interference, particularly in soils, and is therefore selected in the present investigation. It has, however, two other lines one of magnesium, 2798·0 Å and the other of iron, 2797·8 Å, close by, but these three could be easily resolved in the spectrum taken with an automatic large quartz spectrograph used.

Synthetic soil base,[4] containing 2% magnesium oxide and 5% iron oxide was prepared and seven mixtures containing 50, 100, 200, 500, 1000, 1500 and 2000 p.p.m., manganese were made out of it. These finely ground mixtures were made into consistent pastes with dilute nitric acid and then arced on copper electrodes of 5 mm. diameter at 6·5 amperes arcing current. the arcing conditions were kept constant throughout the investigation. The microphotometric records of the spectra recorded in the 2300 Å, region for three samples arced, are given in Fig. 1. The magnesium line 2798·0 Å, recorded in the spectrum obtained using the soil base, Fig. 1*a*, is found to be as strong as the neighbouring iron line 2797·8 Å, taken as the internal comparison standard. The base is free from manganese contamination as no line due to manganese could be recorded. In the spectrum obtained with a mixture containing 50 p.p.m., manganese, Fig. 1*b*, the appearance of the manganese line is followed by the suppression in the intensity of the magnesium line 2798·0 Å, as compared to the intensity of the internal standard iron line which remained almost unaltered as desired under constant conditions of arcing. This suppression was observed in the spectra recorded for the rest of the samples also and the relative intensities of the two lines, more or less, remained the same as in Fig. 1c., for all the samples studied.



Suppression of Magnesium line by Manganese in the arc Spectrum of a Synthetic Soil Matrix.

a. Synthetic Soil Base

b. Soil Base with Manganess 50 p.p.m.

c. " " " 200 p.p.m.

It is possible that the intensity of the manganese lines also might have been affected relative to the iron standard but with the present data it is difficult to assess that. The other magnesium lines in the neighbourhood *viz.*, 2302·7 Å, and 2795·5 Å, are too strong to throw any light while the weaker lines 2790·8 Å, 2776·7 Å, and 2781·4 Å, seem to be suppressed. A detailed study of the intensities of the lines and the interactions between the atoms in an arc is in progress.

Indian Agric. Res. Inst., C. DAKSHINAMURTI.
New Delhi, B. RAMAMOORTHY.
February 21, 1951.

---

1. Cholak, J. and Story, R. V., *J. Opt. Soc. Amer.*, **1941, 31,** 730. 2. Milbourn, M., *J. Soc. Chem. Ind.*, **1937, 56,** 205T. 3. Rama Moorthy, B., and Desai, S. V., *Ind. Jour. Agric. Sci.*, **1946, 16,** 103. 4. Mitchell, R. L., "Commonwealth Bureau of Soil Science Technical Communication," **1948, 44,** 81.

A NOTE ON THE ABNORMAL DIURNAL VARIATION OF THE RECEIVED FIELD INTENSITIES

DURING the course of a study of the diurnal variation of the field intensities of the short-wave transmissions of the Madras (7260 kc/s), Calcutta (7210 kc/s, 6010 kc/s) and Bombay (7240 kc/s) stations of All India Radio during the hours 0700 and 0900 Indian Standard Time, some abnormalities were noticed and one of them is reported in this note.

In figure below is presented a typical curve of the diurnal variation of the received field intensities of the above three stations. From the curve it may be seen that the Calcutta and Bombay signals show a like variation whereas the Madras signals exhibit a characteristically different trend. Elsewhere[1] it has been shown that the normal trend of the diurnal variation of the received field intensities for medium distances is to vary with the zenith distance of the sun, the intensities decreasing with time up to noon. This course is followed by the Calcutta and Bombay signals. The intensity of the Madras signals is generally constant or shows a very small variation while the corresponding variation in the field intensities of Calcutta and Bombay signals is by −6 and 8 db respectively.

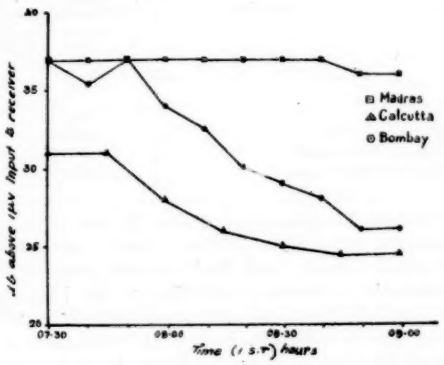


FIG. 1

It is now well known that the D-layer[2] is responsible for the daytime attenuation of the ionosphere-supported transmissions and one will, therefore, be tempted to associate the abnormal behaviour of the Madras signals to a dissimilarity in the D-layer over Waltair-Madras route and the other routes.

The existence of a geomagnetic control of the Ionosphere was first suggested by Appleton[3] to explain the apparent anomalies in the critical frequencies of the F_2 layer at stations scattered all over the world. These anomalies disappeared when they were classified according to magnetic dip instead of geographical latitude. Subsequent work[4,5] also seems to lend support to this view.

Though Madras does not differ widely in geographic latitude from Calcutta or Bombay it does so in magnetic dip value, this being 11° for Madras and 20° and 31° 45′ for Bombay and Calcutta respectively. Further, Madras is nearer the magnetic equator than the other two places, being situtated on the 3° N magnetic latitude. It therefore seems reasonable to attribute the abnormal diurnal variation of the field intensity of the Madras signals to some sort of geomagentic control of the lower regions of the Ionosphere. Complete details will be published elsewhere.

Wireless Research Labs. Y. V. SOMAYAJULU.
Physics Department,
Andhra University, Waltair,
January 31, 1951.

1. To be published. 2. Colwell and Friend, *Nature*, 1936, **137**, 782. Watson-Watt, *ibid.*, 1936, **137**, 866. 3. Appleton, E. V., *ibid.*, 1946, **157**, 691. 4. Mitra, S. K., *ibid.*, 1946, **158**, 668. 5. Baral, Ghosh and Debray, *ibid.*, 1948, **161**, 24.

TRYPSIN INHIBITOR IN FIELD BEAN (*DOLICHOS LABLAB*)

DURING the course of an investigation on the digestibilities of germinated pulses (unpublished work), the proteins of field bean (*Dolichos lablab*) were found to be very resistant to tryptic digestion. It was thought that the apparent non-digestibility of these proteins may be due to the existence of a factor in the pulse which strongly inhibits the tryptic activity. The existence of a trypsin inhibitor in soybean and in navy bean has been reported by Ham and Sandstedt[1] and by Bowman[2] respectively. So it was felt to be of interest to see whether a similar type of inhibitor is also present in field bean and also to study the effect of germination on the same. With this in view, a reaction mixture consisting of 40 c.c. of 5% skimmed milk solution, 5 c.c. of 2% trypsin solution, 5 c.c. pulse extract and 10 c.c. of phosphate buffer (pH 7·7) was kept at 37° C. and the extent of hydrolysis in one hour was estimated by formol titration using 10 c.c. aliquot of the reaction mixture. Proper controls were performed. The pulse extract was prepared by grinding 10 gm. of the pulse with 25 c.c. of the buffer and squeezing the meal through cloth. Table I represents results of a typical experiment:—

TABLE I

Percentage inhibition of tryptic activity by field bean extract

	Experiment	Percentage inhibition
1	Skimmed Milk + trypsin ..	0
2	,, ,, + ungerminated pulse extract ..	81·39
3	,, ,, + ,, ,, (autoclaved) ..	−22·5
4	,, ,, + ,, ,, (heated in water-bath for 10 min.) ..	60
5	,, ,, + ,, ,, (heated in water-bath for 20 min.) ..	47·5
6	,, ,, + ,, ,, (heated in water-bath for 1 hour) ..	10·0
7	,, ,, + soaked pulse extract (soaked for 12 hrs.) ..	80·0
8	,, ,, + 24 hrs. germinated pulse extract ..	70·0
9	,, ,, + 48 hrs. ,, ,, ..	79·48
10	,, ,, + 72 hrs. ,, ,, ..	74·35

It will be seen from the table that (i) the field bean contains a trypsin inhibitor, the concentration of which does not increase on germination, (ii) the activity of this inhibitor gradually decreases on heating in a boiling water-bath; in one hour the activity falls from 81·39 to 10%, (iii) the inhibitor loses its activity on autoclaving for 20 minutes at 15 lbs. pressure; in this case there is an activation of the tryptic digestion.

Preliminary trials showed that the trypsin inhibitor of field bean could be extracted with 5% sodium chloride, dilute hydrochloric acid or water. However, 0·05 N hydrochloric acid was found to be a more suitable solvent and hence in subsequent experiments for isolating the inhibitor, this strength of the acid was used.

The inhibitor was isolated by extracting it with 0·05 N HCl. The filtrate was half saturated with ammonium sulphate. The precipitate was suspended in water and dialysed for 40 hours at room temperature in a cellophane bag against running tap water. The contents of the dialysing bag were centrifuged. The inhibitor was found to be present in the supernatant liquid. The supernatant liquid was divided into two equal portions. One portion was precipitated with alcohol and the other with acetone. The precipitate was washed with alcohol or acetone as the case may be, and finally with ether. It was dried *in vacuo* over phosphorous pentoxide. The degree of purity of the inhibitor attained at different stages of isolation was determined by calculating the inhibitor units. One unit of trypsin was taken, as defined by Anson,[4] as the amount which digests hemoglobin under standard conditions at an initial rate such that there is liberated per minute an amount of split products not precipitated by trichloroacetic acid which gives the same colour with phenol reagent as one milliequivalent of tyrosine. In these investigations, casein was used as a substrate and the experiment was carried out at 37° C. The inhibitor unit as defined by Borchers *et al*[3] as that amount which will reduce the activity of trypsin from one trypsin unit to 0·75 trypsin unit has been used in this investigation. The results are given in Table II.

TABLE II

Degree of purity of the inhibitor at different stages of isolation

Stage of Isolation	Inhibitor units per mgm. of the preparation
	$\times 10^{-6}$
HCl extract ..	139·8
Dialysed extract ..	695·05
Acetone precipitate ..	871·3
Alcohol precipitate ..	931·3

It will be seen from Table II that the final preparation is about 6 to 7 times purer than the HCl extract, and that alcohol precipitation results in a better preparation of the inhibitor.

The inhibitor does not affect the peptic activity nor does pepsin destroy it.

Dept. of Biochemistry, M. K. GAITONDE.
Institute of Science, KAMALA SOHONIE.
Bombay,
April 16, 1951.

1. Ham and Sandstedt, *J. Biol. Chem.*, **1944, 154,** 505. 2. Bowman, *Proc. Soc. Expt. Biol. Med*, **1944, 57,** 139. 3. Borchers, R., Ackerson, C. W., and Sandstedt, R. M., *Arch. Biochem.*, **1947, 12,** 367. 4. Anson, M. L., *J. Gen. Physiol.*, **1938-39, 22,** 79.

REVIEWS

Memoirs of My Working Life. By Sir M. Visvesvaraya. Published by the author, 'Uplands', High Ground, Bangalore. Price Rs. 6.

The one aim in life of the author has been "to plan, promote and encourage developments chiefly in education, industries, commerce and public works to enable the people to work well, earn well and live well".

This book is a record of his endeavours in pursuit of this aim. He has achieved notable success in many spheres. As irrigation and sanitary engineer, he won laurels in early life in the Bombay Presidency and then as Special Consulting Engineer in Hyderabad and as Chief Engineer in Mysore. Long before T. V. A. was conceived, Sir Visvesvaraya executed the multipurpose development of the Cauvery River consisting of a storage reservoir of 48,000 million cubic feet of water, 150,000 acres of irrigated lands and hydroelectric installation of 80,000 H.P. It required unusual boldness, vision and administrative ability to set up an iron and steel works based on the use of charcoal in the Mysore State. Such faith can achieve the impossible; and today, Mysore is very much the richer for the trust her Government and people have reposed in him.

For more than three decades after retirement from Public Service, Sir M. Visvesvaraya has devoted himself incessantly to the task of developing the resources of the land, both human and material, with the utmost intelligence, enterprise and vision. At the age of 90, fired by the divine discontent that his people still continue to be "slow, sleepy and easygoing", he is as active as ever, preaching the doctrine of intelligent and disciplined work, of self-help, and of risk-taking. May his countrymen profit by his advice and his example! Then, they may be sure that the dawn of new life, which was ushered in four years ago, will break into a bright day of prosperity and happiness.

J. C. G.

Theory of Probability. By M. E. Munroe. (McGraw Hill Book Company, Inc., New York, U.S.A.), 1951. Pp. viii + 213. First Edition. Price $ 4·50.

This book is an attempt to give a semi-rigorous presentation of the modern theory of probability in its true flavour, with the concept of the stochastic variable leading on to the Central Limit Theorem and the weak and strong Laws of Large Numbers. The whole performance is mostly at the undergraduate level and forms an admirable Introduction to Cramer's "Mathematical Methods of Statistics" and Uspensky's "Introduction to Mathematical Probability," of which this work is a mild and digestible version. There is a delightful and wide variety in the examples discussed, from the standard game at Monte Carlo played with a wheel containing 37 equally spaced slots and the probabilities of gene types to the random walk problem dealing with the probable position of an aimless itinerant, tests for extra-sensory perception, radio-active disintegrations and the normality of a decimal expansion. To assist computations in probability theory, the author has provided the formulæ of Beta and Gamma functions with reasonable proofs and has also ventured to the depths of Stirling's theorem in the form $n! = n^{n+\frac{1}{2}} e^{-n} \sqrt{2\pi}\, e^{\epsilon_n}$ where $1/(12n+6) < \epsilon_n < 1/12n$ and $\int_{-\infty}^{\infty} (\sin x/x)\, dx$. We are just given a glimpse of some high peaks in the distance like the law of Iterated Logarithms and Lindeberg-Feller Central Limit Theorem, through informal discussions. Elucidation of the properties of convergence in probability and their applications to sampling as well as the significance of the Bernoulli, Normal and Poisson distributions form the cream of the book.

On the whole, it is a highly informative and stimulating work. It should prove a worthy guide to the young student aspiring to climb the austere heights of modern Statistical Theory. There are as many as 300 exercises set to satisfy the plodder. We recommend this book strongly to all students and teachers of Statistics in our Universities.

Print, paper and figures are of the high excellence expected of a McGraw Hill publication. The reviewer has been able to detect only one misprint (*i.e.*, on page 175, $\sqrt{2m-1+z}$ should read $\sqrt{2m-1}+z$).

A. A. K. Ayyangar.

Elasticity. (McGraw-Hill Book Company, New York), 1950. Pp. v + 283. Price $ 6.00.

This volume contains the proceedings of the third symposium in Applied Mathematics of the

American Mathematical Society held at the University of Michigan from June 14th to June 16th, 1949. It is a collection of 17 full length papers presented at the Symposium and represents recent developments in certain Sections of Elasticity and Plasticity made by specialists in these fields. Compared to the two previous volumes of this series, this contains more readable matter.

The contributors to the volume include I. S. Sakolnikoff, Eric Reissner, B. R. Seth, D. L. Holl, H. Poritsky, W. Prager and P. S. Symonds. The subjects treated include anisotropic problem, finite strain, bending of thin shells and plates, and elastic-plastic straining.

The book is wholly a reference volume and will be useful to mathematicians, physicists and engineers interested in the theory or application of Elasticity.

B. R. SETH.

Text-book of Organic Chemistry. By Louis F. Fieser and Mary Fieser. (D. C. Heath & Co.), 1950. Pp. 332. Price $6·00.

The volume under review is intended for a one-year introductory course in organic chemistry. It maintains the high standard that one expects in books written by Prof. Fieser. The development of the subject-matter is the same as in the second edition of the larger book *Organic Chemistry* by Prof. and Mary Fieser. The present book is, however, more concise and being intended for an introductory course, topics on biochemistry, technology and reaction mechanisms have either been deleted or considerably abridged. The treatment of the subject follows the same pattern as the larger book by the authors. The order in which different organic compounds are presented is conventional except in the case of aliphatic acids which precede aldehydes and ketones in the present as also in the larger book by Fiesers. The chemistry of functional derivatives of aliphatic acids is not discussed separately unlike most text-books on organic chemistry; chapters on aliphatic cyanide and nitro compounds and on sulphur compounds should have been included. The subject-matter included in Chapter 12 on "Ring Formation" is rather heterogeneous; thus it includes other topics such as dicarboxylic acids, β-keto acids, tautomerism and hydroxy acids.

The chemistry of aromatic compounds is dealt with very satisfactorily. In the list of dye intermediates from naphthalene, J-acid, H-acid, and γ-acid should have been included. The book contains a chapter on heterocyclic compounds which is a welcome addition to the subject-matter discussed in the larger book by the authors. Unfortunately in spite of the increasing importance of heterocyclic chemistry it has been dealt with rather sketchily, a defect which is common with many other text-books on organic chemistry.

Among the very few inaccuracies which were noticed are: Patent claims as regards chlorination of Indanthrone in the 3:3'-positions have yet to be substantiated; in fact 3:3'-dichloroindanthrone is prepared synthetically from 3-chloro-1-bromo-2-aminoanthraquinone or 1 : 3-dichloro-2-aminoanthraquinone (see p. 634). Flavanthrone is not technically prepared from 2-aminoanthraquinone by the action of antimony pentachloride (see p. 634).

The chapter on physiologically active compounds is a remarkably comprehensive account of such diverse and extensive subjects as, vitamins, water-soluble and lipoid-soluble factors, steroids, chemotherapeutic agents including arsenicals, antimalarials, sulpha drugs and antibiotics such as streptomycin, aureomycin and chloramphenicol.

Each chapter begins with a useful tabular summary of compounds and their properties, such as m.p., b.p., sp. gr., pKa or pKb (in the case of acids and bases). The printing, diagrams, equations and formulas are excellent. The equations also include such useful data as the important reactants employed, temperature and yields. At the end of each chapter a summary of the subject discussed in the chapter is given—an innovation which is highly recommended as it will assist the student in his ability to assimilate the fundamentals of the subject and also to revise it in a short time. Thus, the student can compile his own summary of the chapter and then compare it with the author's summary. This will ensure his capacity to reproduce known facts. The summary is followed by problems whose solutions are given at the end of the book. These fulfil the second step in the assimilation of the subject, *viz.*, application of established knowledge to the study of the unknown. The reading references which follow are of help not only to the beginner but also to the advanced student. Information on bond distances, bond energies, resonance energies, properties of solvents, electronegativity values and inductive effects is given at the end of the book in tabular form.

The book is an extremely valuable addition to text-books on organic chemistry, especially for Junior and Senior B.Sc. students.

B. D. T.

Industrial Microbiology. By S. C. Prescott and Cecil G. Dunn. Second Edition, (McGraw-Hill Book Company Inc., New York), 1949. Pp. xii + 923. Price $8.50.

The first edition of this well-known volume on Industrial Microbiology was issued in 1940, and during the decade that has passed numerous advances in the fundamental and applied aspects of the subject have been made, thanks particularly to the rapid and spectacular expansion of the fermentation industry in the U.S.A.

The authors have taken advantage of the new edition of the volume to include these advances and bring the subject up to date. Among the features of the new edition attention should be invited to the complete revision of the chapters on yeast and its products. The latest information on riboflavin production has been included. Five new chapters on saccharifying agents, yeast production and yeast products, production of 2, 3 butanediol, itaconic acid and antibiotics, have been added. There is nearly a 70 per cent. increase in the volume of scientific matter included in the new edition.

The authors have rendered a great service to the subject of industrial microbiology by publishing this new edition. We have used this as a text for advanced training in Fermentation technology and as a constant book of reference in the course of our researches. This is a volume which will be gratefully welcomed by every student of applied microbiology.

Vitamins and Hormones, Vol. VIII. Edited by R. S. Harris and K. V. Thimann. (Academic Press Inc., New York), 1950. Pp. xi + 342. Price $ 6.80.

The eighth volume of the series 'Vitamins and Hormones,' edited by R. S. Harris and K. V. Thimann, contains eight articles, four on the subject of vitamins and the rest on hormones. The subject-matter of these articles have been carefully chosen and presented in such an elegant fashion, that the high standard attained in previous volumes has been well maintained. The first article on 'Animal Protein Factor and Vitamin B12 in the Nutrition of Animals,' has been written in an exceedingly clearcut manner by T. F. Zucker and L. M. Zucker and several controversial issues ably presented. In view of the rapid advances in this field, however, one has soon to supplement this information by recourse to recently published papers on the subject. 'Pyridoxine in Relation to Fat Metabolism' has been written by H. Sherman from Harris' Laboratory, with particular emphasis on the interrelationship which exists between this vitamin and the unsaturated fatty acids, while the third article by W. J. van Wagtendonk and R. Wulzen, gives in detail the physiological and chemical aspects of the anti-stiffness factor essential for the guineapig. 'Vitamins and Metabolism in Neurospora' by H. K. Mitchell, is an article which describes among other things the recent advances made on the manner of biosynthesis of some of the water-soluble vitamins using several Neurospora mutants for the purpose. 'The Physiology of Relaxin' by F. L. Hisaw and M. X. Zarrow, 'Interactions between Estrogens and Progesterone' by R. Courrier, 'The Physiological Actions of the Hormones of the Posterior Lobe of the Pituitary Gland' by R. L. Stehle, written as Part II of the article, published in an earlier volume of this series, and lastly 'Steroid Configuration' by C. W. Shoppe comprise the four articles on hormones. They have been written by authorities in the respective fields and are very interesting and thought-provoking in their scope and content. A few more articles could have been usefully included on interrelationship among vitamins and hormones in this volume, in view of the growing importance of the subject in recent years. However, the volume as such is quite valuable and should prove a real acquisition to all those who are interested in the twin subjects of vitamins and hormones.

P. S. SARMA.

Poisons. *Their Isolation and Identification.* By Frank Bamford. 3rd Edition; Revised by C. P. Stewart. (London: J. & A. Churchill Ltd.), 1951: Pp. viii + 316. Price 25 *sh.* net.

The third edition of this book, the first and second editions of which appeared in 1940 and 1947 respectively, is practically a reprint with minor additions and alterations. There has been some additions in the section on barbiturates. Earlier editions dealt with relatively smaller number of these compounds which came within the purview of the author. The present edition describes a more recent and comprehensive method for their identification based primarily on colour reactions. It also describes a volumetric method and a colorimetric method for estimating small amounts of arsenic in tissues. Another addition, unimportant though from a practical toxicologist's point of view (for whom this book is primarily meant), is a few short hints it contains on the antihistaminic drugs. A few useful changes in the general plan of the book have been made, *e.g.*, gaseous and volatile poisons have been dealt with in the same chapter; the chapter on methods of isolation of organic poisons precedes their systematic testing.

The subject-matter of the book has been largely drawn from the author's rich practical experience in the isolation and identification of poisons in human poisoning cases, a subject of highly specialized nature. This book is not meant for theoretical reading or as a text-book. But, in the hands of a trained chemist who intends taking practical toxicology as his profession, this book should prove a very useful guide.

Insecticides. *World Health Organization's Technical Report Series*, No. 34. Pp. 82. Price 4*sh.* 3*d.*

The report constitutes the beginning of what will probably become an international manual on insecticides and spraying apparatus.

The first section of the report deals with disinsectization methods for quarantine purposes, making specific recommendations concerning procedures for the disinsectization of aircraft and ships. It suggests, however, that sanitary regulations governing the *routine* disinsectization of aircraft and ships apply only to "areas suspected of being infested with insect vectors of disease....to such a degree that they represent a danger to other countries." Annexes to the report provide itemized time and cost estimates for various quarantine operations.

A major part of the report is devoted to specifications for insecticides and their formulations, including technical DDT, technical benzene hexachloride (12-14% gamma BHC), gamma-isomer benzene hexachloride concentrates (90% and above), technical chlordane (agricultural and refined grades), methoxychlor, wettable powder concentrates of DDT and BHC, and DDT emulsion concentrates. Packing and marking of packages are also recommended for each insecticide. Annexes describe test procedures for determining the chemical composition and physical characteristics of the various insecticides, *e.g.*, the Winter, Parr peroxide-bomb, and Stepanow methods for determining total organic chlorine content; the polarographic and chromatographic methods for determining gamma-isomer content of technical BHC; maximum diameter (particle size) determination, agglomerate test, settling rate, and tropical storage tests for DDT wettable powder concentrates; and flash point determination (TAG Closed Tester and Cleveland Open Tester methods) for DDT emulsion concentrates.

A section on spraying apparatus gives detailed specifications for knapsack/compression sprayers, hnnd sprayers, and stirrup pumps.

This report should be a valuable tool for all who are concerned with environmental sanitation and the control of insect-borne diseases, as well as for manufacturers, buyers, and users of insecticides and spraying apparatus for their application.

Bulletin of the Central Research Institute, University of Travancore, Trivandrum. Series A, B and C. 1950.

There are excellent reasons why every University should have a Bulletin of its own, particularly in the field of the Sciences. Not the least perhaps is the one connected with the great pressure on space in Journals of an all-India character. The University of Travancore therefore deserves our heartiest commendation for bringing out the opening numbers of the series this year. A scrutiny of its contents shows that great care has been taken to maintain a high standard in the selection of papers for publication.

The Tuberculosis Association of India—(1) *Twelfth Annual Report*, 1950; (2) *Proceedings of the Twelfth Annual General Meeting*, 1951; (3) *Directory of the Tuberculosis Institutions in India*—1950.

The first two publications summarise the activities of the Association and make brief references to certain developments in the anti-tuberculous campaign undertaken by the Central and State Tuberculosis Associations and Governments during 1949 and 1950. One of the most important activities has been the Seal Sales Campaign. This campaign, has created a mass consciousness against tuberculosis, which is as important as, if not more so, than cash returns. The magnitude of the tuberculosis problem in India can be gauged from the fact that it claims a victim almost every minute, and for every case of death there are at least five spreading the infection. Besides the emphasis laid on the preventive measures such as B.C.G. vaccination, an effective Tuberculosis Service including the isolation, treatment and rehabilitation of tuberculosis patients and the development of a Social Service Organisation, it is gratifying to note the welcome approach towards "Research in Tuberculosis". The Association has realised that India should not merely be a borrower in the scientific markets of the world but should earnestly undertake this important phase of anti-tuberculosis work".

"The Directory of the Tuberculosis Institutions in India, 1950." provides useful and reliable information about sanatoria, hospitals, dispensaries and medical institutions where facilities for treatment of tuberculous patients exists. It is a comprehensive and up-to-date guide and the Association has to be congratulated on making the Directory available to the public.

M. SIRSI.

British Scientists. By E. J. Holmyard. (Published by J. M. Dent & Sons, London). Pp. viii + 88. Price 6 *sh.* net.

In the handy little volume under review, Professor Holmyard has briefly but skilfully touched upon the landmarks in the history of British Science from the very earliest days well into the first half of the present century also. Representative of the various stages in the story of its development, names of great scientists have been chosen as chapter headings with a view to indicate the part played by them. The nature of the contents as well as the method smake it clear that this is more the biography of British Science than of British Men of Science. Even so, its merit as a biography is *par excellence*, judged by all standards, both literary and scientific. Excellently produced and tastefully illustrated, the volume can be heartily recommended to everyone who would like to recapture the really great moments in the evolution of British Science.

Books Received

Plane Analytic Geometry. An Intermediate Course, 1st Edition, by A. B. Shah & Apte, M., Poona 2, 1951, pp. vi+252, Price Rs. 5-8-0.

Studies on the Natural Fats, Vol. I, Parts I-III. Summary of Ph.D. Thesis, 1949, by A. R. S. Kartha, Ernakulam, 1951, Pp. 145, Price Rs. 5.

Soil Scince. An Elementary Text-Book. I Edition, by A. N. Puri, M/s. Minerva Book Shop; The Mall, Simla, 1951, Pp. 156, Price Rs. 8.

Principles of Fruit Preservation, 3rd Edition. Revised by T. N. Morris, 1951, Pp. xiii+208, Price 21 *sh.* net, M/s. Chapman & Hall, London W.C. 2.

Austenitic Grain-Size Control of Steel, by B. R. Nijhavan & A. B. Chatterjee, C. S. I. R., 1951, Pp. 58, Price Rs. 3.

Laboratory Manual of Qualitative Organic Analysis, 2nd Edition, by H. T. Openshaw, M/s. Cambridge University Press, 1951, viii +94, Price 8*sh.* 6*d.*

The Oxide Coated Cathode, by G. Herrmann and S. Wagener, M/s. Chapman & Hall, 1951, Pp. viii+148, Price 21*sh.* net.

Organic Chemistry, by J. P. Wibaut, Elsevier Publishing Co., Ltd., 1951, xvi+660, Price 55*sh.*

The Chemistry and Technology of Food and Food Products, by M. B. Jacobs, M/s. Inter Science Publishers, 1951, Pp. xxv+832, Price $ 12·00.

Sugar Industry Annual, 1950, M/s. M. P. Gandhi & Co., 1951, lxxviii + 156, Price Rs. 6.

South African Scenery (A Text-Book of Geomorphology), by L. C. King, M/s. Macmillan & Co., 1951, Pp. xxxi + 379, Price 45*sh.* net.

SCIENCE NOTES AND NEWS

A New Collection of Fossils from the Suket Shales (Vindhyans).

Sri. R. C. Misra, Dept. of Geology, Lucknow University, writes as follows:—

It may be recalled that the collection of certain discoidal fossils from the Vindhyans by Mr. H. C. Jones of the Geological Survey of India in the field session 1907-08 evoked considerfossils were variously iden-able interest. These tified as primitive brachiopods and plant remains. The author has made further collections in October, 1950, from the area and has discovered new forms, which when studied in detail, might yield interesting results. A number of new localities where such fossils occur in extraordinary abundance have also been discovered.

Prof. M. S. Thacker

Prof. M. S. Thacker, Director of the Indian Institute of Science, who has left for the U.S.A. under Truman Point Four Programme, will be visiting various engineering and other research centres, and is expected to participate in the National Technical Conference on Illumination Engineering (Washington) and the First World Metallurgical Congress (Detroit). While returning he will be visiting U.K., France, Germany and Switzerland for consultations, equipment, etc., relating to the Institute.

Historic Observatory of Tycho Brahe

Astronomers and astrophysicists from many countries have been invited by the Swedish Astronomical Society to the island of Ven between Sweden and Denmark, to commemorate the 350th Anniversary of Tycho Brahe on 14th October of this year.

The celebrations will include the re-inauguration of Tycho-Brahe's observatory, Stjarneborf, which is now being excavated, while the excavation of Uranienborg, another Brahe

observatory situated at some 100 yards from it will be carried on later (UNESCO).

International Symposium on the Reactivity of Solids

The Royal Swedish Academy of Engineering Sciences and the Chalmer's University of Technology have decided to arrange an international symposium in Gothenburg during 9th to 13th June, 1952, for discussing problems concerning the reactivity of solids.

Professors G. W. Brindley, G. Chaudron, V. Frechette, P. Gilard, O. Hahn, J. A. Hedvall, P. Niggli, G. M. Schwab, P. Schwarzkopf and W. Steger are expected to participate in the preliminary programme. All communications regarding the symposium should be directed to Mr. Lennart Simonsson, Royal Swedish Academy of Engineering Sciences, Box 5073, Stockholm 5, or to Professor J. A. Hedvall, Chalmers' University of Technology, Gothenburg.

Symposium on the Social Relations of Science

The Delhi Branch of the Association of Scientific Workers of India proposes to convene a symposium on the above subject in the beginning of September this year. Those who would like to participate in the symposium may please write to Shri M. L. Aggarwal, Secretary, Delhi Branch, Association of Scientific Workers of India, 1/3, Kishen Nagar, Karol Bagh, New Delhi.

Dr. Bharucha

Dr. F. R. Bharucha, Acting Principal and Professor of Botany, Institute of Science, Bombay, has been elected a Member Correspondent of the *Svense Vaxtgeografiska Sallskapet*, Uppsala, Sweden. He is the first Indian Botanist to be so elected.

Dr. Bharucha has also been elected to the Editorial Board of *Vegetatis*, an International Journal of Phytogeography, Holland.

Award of Research Degree

On the recommendation of the Board of Examiners consisting of Professors R. W. B. Pearse, R. F. Barrow and W. Jevons, the thesis entitled "Electronic Transitions in Substituted Benzenes in the near Ultra-Violet" by Sri. K. Sreeramamurthy, M.Sc., has been declared qualified for the Degree of Doctor of Science of the Andhra University.

Prof. R. S. Krishnan

Prof. R. S. Krishnan who is now in Europe to participate in two international conferences, will be giving a series of lectures in Egyptian Universities in September of this year.

Indian Mathematical Conference

The Seventeenth Conference of the Indian Mathematical Society will be held in Bangalore in the last week of December, 1951, under the auspices of the University of Mysore. Members who wish to read papers should send abstracts, not exceeding 300 words, to Dr. K. Chandrasekharan, Tata Institute of Fundamental Research, Apollo Pier Road, Bombay 1, before the end of October, 1951.

Mr. B. Rama Rao

After a long and meritorious service rendered to the country as Geologist and Mining Engineer, Mr. Rama Rao, former Director, Indian Bureau of Mines, has now retired from active service.

He was the President of the Geology and Geography Section of the Indian Science Congress in 1936, and also of the 6th Geographical Conference in the same year, and of the Geological, Mining and Metallurgical Society of India in the years 1942 and 1943. Mr. Rama Rao was also a Delegate of the International Geological Congress held at Washington (U.S.A.) in 1933.

Annual Essay Contest—His Excellency Raja Maharaj Singh Certificate

The Division of Food Information and Statistics of the Central Food Technological Research Institute, Mysore, announces that H. E. Raja Maharaj Singh Certificate will be awarded this year to the best essay on "Future of Canning Fruits and Vegetables in India". The essay should not be more than 4,000 words in length and should be submitted by the 31st December 1951 to the President of the All-India Food Preservers' Association, 18-A, Aurangazeb Road, New Delhi.

Indo-German Industrial Co-operation

The Government of India have received offers for 50 Free Studentships at German Universities and Technological Institutes and also for training of a number of Indian engineers and apprentices in workshops of heavy industries in Germany. As a measure of reciprocity, the Government of India have decided to award 10 Free Studentships to Germans for the study of Indian Languages, Religion and Philosophy at Indian Universities.

Secretary: M. Sreenivasaya, B.A., F.I.I.Sc., F.A.Sc. Editor: G. N. Ramachandran, M.A., Ph.D. D.Sc., F.A.Sc.
798-51 Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent and Published by Dr. M. A. Govinda Rau, M.A., Ph.D., for the Current Science Association, Bangalore